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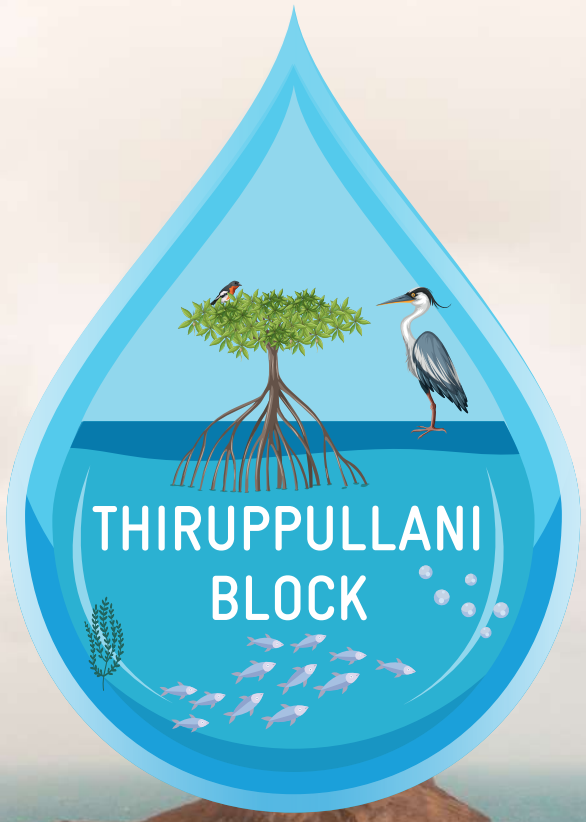
Ministry of Rural Development | Ministry of Jal Shakthi

WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



SUSTAINABLE DEVELOPMENT GOALS

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

District Rural Development Agency, Ramanathapuram &
WASCA, GIZ, New Delhi

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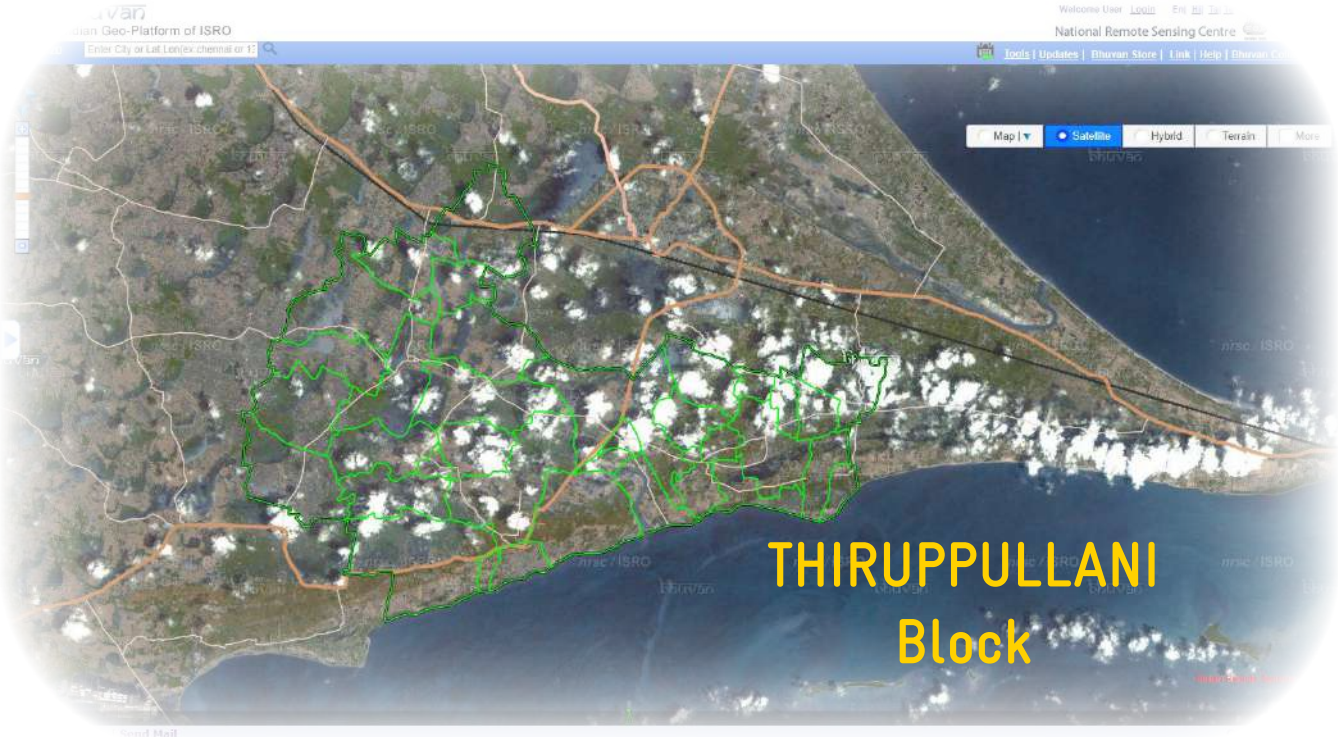
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

District Rural Development Agency, Ramanathapuram &
WASCA, GIZ, New Delhi

FOREWORD

Thiru. Praveen P. Nair, IAS
Director of Rural Development
and Panchayat Raj

Tamil Nadu government is implementing the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) by assuring adequate and accessible wage employment while simultaneously creating productive individual and community assets to fulfil the infrastructure and livelihood needs of the people in rural areas. The Government intends to prioritise the strategies under this scheme to focus on creating Climate Resilient Villages and individual income generating assets and works in the coming years in a convergence model.

> "Close to 10 lakh NRM and Non- NRM works are identified, verified, approved by Gram Panchayat"

There will be a reorientation of priorities under MGNREGS with livelihood promotion and poverty alleviation as goals in addition to Natural Resource Management, asset creation and agriculture development. The approach to Natural Resource Management will be on a saturation mode with GIS based planning. The impact of each intervention will be maximised through convergence.

In this context, implementation of Water Security and Climate Adaptation (WASCA) a technical cooperation project GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH) Indo-German Technical Cooperation project in Tamil Nadu is of paramount importance. WASCA is being implemented in Tiruvannamalai and Ramanathapuram district.

The project focused on GP level planning driven by scientific data, climate information, climate risk, climate vulnerability assessments & ranking, watershed approach, water budgeting (Ground and surface water), land use, agriculture, livestock, soil parameters and GIS thematic maps. A Composite Water Resources Management Planning (CWRMP) frame works is adopted. The GP level works thus identified are mapped to climate vulnerabilities, SDG goals and its Indicators, Intended Nationally Determined Contributions (INDC) for climate Change. This mapping exercise is unique and first of its kind in the country for a plan at GP level.

This approach helped to complete 1,289 GP level plans in holistic way for a period of three years. Close to 10 lakh NRM and Non- NRM works are identified, verified, approved by Gram Panchyat. Out of the shelf of projects, in the year 2021-22 FY, 2,80,000 works are uploaded in NREGA soft GIS planning portal. This is one of the largest number of works uploaded by any district or state for the current financial year.

Under WASCA four major interventions are being undertaken in pilot districts.

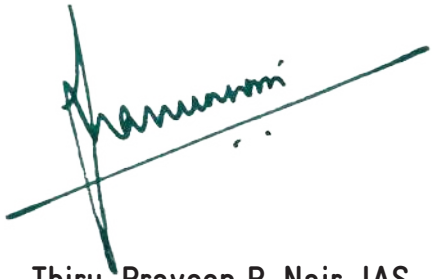
1.	Development of Public and Common lands
2.	Development of Agriculture and allied activities
3.	Development of Rural Infrastructure Management
4.	Development of Climate Resilience Measures

Under the leadership of District Collector, Additional Collector (Development), Engineers of District Rural Development Agencies (DRDA), line departments and GP office bearers the implementation of approved works from WASCA are discussed during monthly district level convergence meetings.

The present Block report is a synthesis of all GPs in the Block discussed in detail on four major heads, Socio-Economic, Climate, Water and Agriculture the key for any rural development. The Block level CWRM book will help the GP, Block officers and Gram Panchayats in planning, implementing works in holistic manner, reducing water scarcity in the district.

I take this opportunity to thank GIZ, the technical partners, District WASCA resource Centres for their continued effort to work with DRDA and State RDPR for making MGNREGS more integrated.

"The block level CWRM book will help the GP, Block officers and Gram Panchayats in planning, implementing works in holistic manner, reducing water scarcity in the district"



Thiru. Praveen P. Nair, IAS
Director of Rural Development
and Panchayat Raj

FOREWORD

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

The Block Level, Composite Water Resources Management Plan is an unique initiative of District Rural Development Agency, Tiruvannamalai & the Indo German project on Water Security and Climate Adaptation in Rural India (WASCA) implemented by GIZ. This is the culmination of three years of efforts by the project team and government officials, assisted by knowledge partners and a myriad of departments. At the national level, this process is anchored in the Ministry of Rural Development and supported by National Water Mission, Ministry of Jal Shakti.

The state government of Tamil Nadu, with core support from Director Thiru. Praveen Nair I.A.S., Department of Rural Development and a host of water related departments, under the active leadership of the District Collector, Thiru. B.Murugesh, I.A.S., has embarked on this strategic response to the strong crisis of water security which is affected by climate change that we are increasingly witnessing. This Block level report uses strong scientific data and analysis using GIS and statistical data to develop a medium-term picture of water and climate and their interactions. These have driven a scenario projection, to respond to which key thrust areas of actions, with their inherent strategies and resultant activities have been brought together into a plan that will work to change this possible reality.

> "Block level report uses strong scientific data and analysis using GIS and statistical data to develop a medium-term picture of water"

As humans, we have to plan to avert the future potential disasters and capture latent opportunities, using the human, technical and financial resources available to us. As wise humans, we should do it strategically to not only adapt to that reality, but to initiate actions that help to mitigate that possible future also along with.

The Block report focuses on sustainable water resource management, as it is the true driver for all development in a natural resource dependent rural livelihood scenario. The climate actions initiated not through separate climate funds, but by leveraging existing public programmes and schemes, such as Mahatma Gandhi NREGA, to act now and decisively.

We sincerely hope that this innovative Block Level plan is not only a success for itself but shows that way how the state government can plan for all of its .... Blocks!

We look forward to its success!

Rajeev Ahal

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

MESSAGES

Thiru. S.S Kumar
Additional Director (MGNREGS),
RD&PR

The Mahatma Gandhi National Rural Employment Guarantee Scheme in Tamil Nadu focuses on Natural Resources Management, Grey Water Management, Farm Ponds in individual lands, afforestation and plantations in community areas, water harvesting and conservation measures. To implement works in saturation mode, it is important to have holistic plans prepared in every Gram Panchayat.

GIZ technical cooperation project on Water Security and Climate Adaptation (WASCA) being implemented in Tiruvannamalai and Ramanathapuram district is an example of holistic GP plans considering the land, water, soil, geology and social aspects.

> **Water Security and Climate Adaptation (WASCA) is an example of holistic GP plans considering the land, water, soil, geology and social aspects**

Through District level GIS resource centres, GIZ with the partners MSSRF build capacity of Block, GP level technical officers of Rural Development Department in completion of 1,289 GP plans. In preparation of GP level plans, Nationally approved Composite Water Resources Management (CWRMP) framework is adopted along with Bhuvan NRSC works ISRO GIS platform.

Total 3,00,000 works identified through CWRM are uploaded in NREGA Soft. The works focused on treatment of all-natural drainage lines, rejuvenation of traditional waterbodies, afforestation, trench cutting, gully plugs, recharge-shaft, farm ponds, check dams, farm bunds, soak pits etc. These works identified through GIS planning are verified on ground and approved by Gram Panchayat.

The Block level report provides the details of the parameters used for preparing plans, analysis of the situation, works for over coming the short term and long-term goals of climate resilience and productive assets. This report will be useful for all functionaries implementing MGNREGS.

Thiru. S.S Kumar
Additional Director (MGNREGS),
RD&PR, Government of Tamil Nadu

MESSAGES

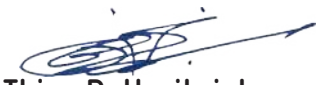
Thiru R. Harikrishnan
Cheif Engineer,
MGNREGS, RD&PR

Water Security and Climate Adaptation (WASCA) a bilateral project of Ministry of Rural Development (MoRD) (MGNREGS), Ministry of Jalsakthi (National Water Mission) and GIZ (German Corporation for International Cooperation GmbH) started in the year 2019-20 and for next three years.

In our state, Centre for Climate Change and Disaster Management (CCCDM-Anna University) has conducted the scoping study based on 18 Vulnerability parameters (Socio-economic, agriculture, water and climate parameters) and identified the most vulnerable two districts for project implementation. The two districts are Tiruvannamalai in Northern Tamil Nadu and Ramanathapuram South coastal aspirational district. For implementing WASCA project Composite Water Resource Management (CWRM) Plan is used.

> "Whole planning process followed a bottom-up approach in identifying appropriate actions based on scientific analysis"

The CWRM plans assessed both the supply and demand for water using data pertaining to land resources, climate parameters, catchment areas, soil, surface runoff, agriculture and prepared a water budget. Besides, it has identified a set of key water actions for the development of public and common land, agriculture and allied activities and rural infrastructure. The whole planning process followed a bottom-up approach in identifying appropriate actions based on scientific analysis. I consider such decentralized level of planning is necessary in ensuring water security in the context of increasing climate change impacts.



Thiru R. Harikrishnan
Cheif Engineer,
MGNREGS, RD&PR

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ABBREVIATIONS AND ACRONYMS

A - D

%
Percentage

^{0}C
Degree Celsius

AR
Assessment Report

CCB
Contour Continuous Bunds

CCCDM
Centre for Climate Change and Disaster Management

CRM
Climate Resilient Measures

CuM
Cubic Meter

CVI
Climate Vulnerability Index

CWRM
Composite Water Resource Management

CWRMP
Composite Water Resource Management Plan

DEM
Digital Elevation Model

D - H

DLSC
District Level Steering Committee

DLT
Drainage Line Treatment

DRD&PR
Department of Rural Development & Panchayat Raj

EC
End Century

ET
Evapo-transpiration

FPO
Farmer Producer Organization

FY
Financial Year

GIS
Geographical Information System

GIZ
Deutsche Gesellschaft für Internationale

Govt.
Government

GP
Gram Panchayat

GW
Ground Water

I - M

ha
Hectare

ha.m
Hectare Meter

HH
Households

ICAR
Indian Council for Agriculture Research

IMD
Indian Meteorological Department

INR
Indian Rupees

IPCC
Intergovernmental Panel on Climate Change

IWRM
Integrated Water Resources Management

km
Kilometer

KML
Keyhole Markup Language

LULC
Land use and land cover

M - N

Max
Maximum

MC
Mid Century

MCM
Million Cubic Meter

Mahatma Gandhi NREGA
Mahatma Gandhi Rural Employment Guarantee Act

Mahatma Gandhi NREGS
Mahatma Gandhi Rural Employment Guarantee Scheme

Min
Minimum

mm
Millimeter

MoEFCC
Ministry of Environment, Forest and Climate Change

MoJS
Ministry of Jal Shakti

MoRD
Ministry of Rural Development

m
Meters

NAPCC
National Action Plan on Climate Change

N - S

NARP
National Agricultural Research Project

NADEP
Nadepkaka

NDC
Nationally Determined Contributions

NEM
North-East monsoon

NGO
Non-Governmental Organization

NITI
National Institution for Transforming India

No.
Number

NRM
Natural Resource Management

NRSC
National Remote Sensing Centre

NWC
National Water Commission

PWD
Public Works Department

Rabi crop
Sown in winter and harvested in monsoon

S - U

RDPR
Rural Development & Panchayat Raj

RF
Reserve Forest

RTRWHS
Roof top rain water harvesting structures

RWHS
Rain Water harvesting System

SAPCC
State Action Plan on Climate Change

SC
Scheduled Caste

SDG
Sustainable Development Goal

SDMA
State Disaster Management Authority

SDMRI
Suganthi Devadasan Marine Resources Institute

SECC
Socio Economic and Caste Census

SHG
Self Help Group

SLSC
State Level Steering Committee

S - W

ST
Scheduled Tribe

SWM
South-West monsoon

SW
Surface Water

TN
Tamil Nadu

WASCA
Water Security and Climate Adaptation

WCWH
Water Conservation and Water harvesting

வான்நின்று உலகம் வழங்கி வருதலால்
தான்அமிழ்தம் என்றுணரற் பாற்று

குறள் - 11

The genial rain ambrosia call
The world but lasts while rain shall fall

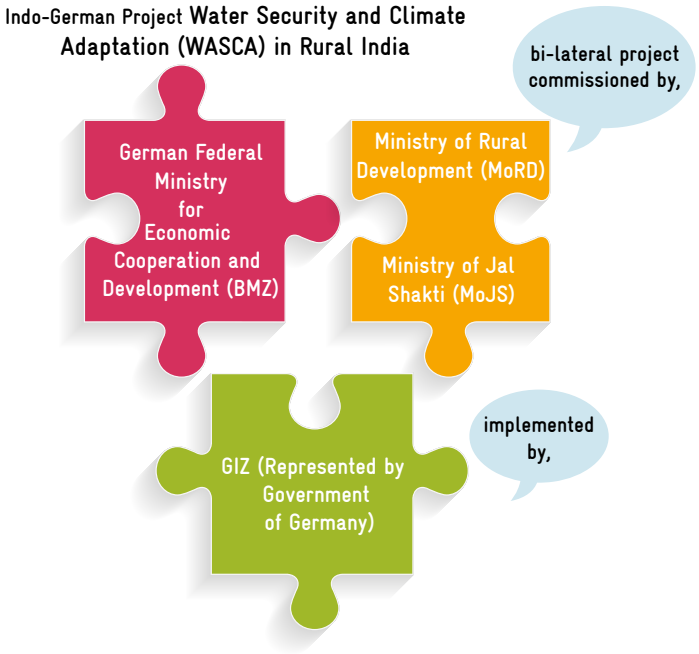
Thirukkural - 11

EXECUTIVE SUMMARY

> "Aims to improve water resource management with respect to water security and climate adaptation"

Water security is one of the most alarming issues and key challenges that the world is facing today given the rapid changes in climate. India is not an exception and is facing a similar challenge. Water security is of prime concern especially in the rural areas due to scarce resources and a high dependency on natural resources. To mitigate the ill effects of climate change and focus on efforts to improve water resource management requires a thorough understanding of all key issues. Climate change adaptation and water security strategies have to be evolved with the help of technical knowledge and integrated into the development planning processes across the Nation, State and local level, for holistic and sustainable impacts.

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 part¬nership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) and implemented by GIZ (Represented by Government of Germany). This project aims to improve water resource management with respect to water security and climate adaptation with an effort to establish a framework for integrating water perspectives into planning and implementing adaptation actions that promotes climate resilience. It is implemented under technical co¬operation from BMZ-GIZ with implementation under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA/S) and National Water Mission (Catch the Rain Campaign) under MoRD, MoJS respectively. In Tamil Nadu State, the project is jointly implemented by the Department of Rural Development & Panchayat Raj, (DRD&PR) Government of Tamil Nadu, Chennai and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, New Delhi.



Initially WASCA Tamil Nadu conducted a preliminary state level scoping study on the State's Rural Water Security using the 18 vulnerable indicators, which covered four important and interconnected parameters/areas of Climate extremities, water resource, agriculture and socio-economic at the district level. Based on the outcomes of the assessment, Tiruvannamalai and Ramanathapuram districts were given priority by the State Level Steering Committee headed by the Additional Chief Secretary, RD&PR in November 2019 for implementing the WASCA. These 18 indicators were further studied at the Gram Panchayat (GP) level integrating the Composite Water Resource Management (CWRM) and MGNREGA/S approach to identify the key problems and propose key actions for implementation in each district. With focus on water-related climate action and integrat¬ed water resource management (IWRM) principles, the project WASCA aims to significantly contribute towards Sustainable Development Goals for ensuring efficient, sustainable, and inclusive water outcomes. Implemen-tation of key water actions also support the National Water Mission, one of the eight missions under the National Action Plan for Climate Change (NAPCC) to achieve their ob¬jective of promoting basin level IWRM. It also explored possible contributions towards the larg¬er goals of Nationally Determined Contribution's (NDC) of climate adaptation through its work on improving water efficiency in agriculture and allied sectors and ecosystem devel¬opment. The State and District Steering Committee approved the process during May 2020 and the whole progress was jointly accomplished with research organ¬izations and key sectoral experts in February 2021.

Subsequently, the District Collector, Tiruvannamalai, en¬trusted preparing Block level reports of water security and cli¬mate adaptation for each Block. This Block level report is intended for all planners and managers responsible for addressing issues of adaptation in natural resource management and water-dependent economic sector and for those who provide support to achieve a coherent and strategic response to adaptation planning. This report also helps all stakeholders involved to understand the issues related to water security in the context of climate change in rural areas and actions through Mahatma Gandhi NREGS and the need for convergence with concerned line departments.

Block level report is intended for all planners and managers responsible for addressing adaptation in natural resource management and water-dependent economic sector

This report is structured with nine complete chapters

1

First chapter outlines the generic demographic, socio economic and hydrological aspects of the Block

2

Second chapter addresses water security through the lens of changing climate. The past and future climate change scenarios are discussed along with climate risks. The 18 vulnerability indicators used in WASCA TN's scoping study are summarized and analysis on Block level vulnerability assessment are briefed

3

Third chapter elaborates the process of CWRM approach and its framework along with categorization of GPs, collection and analysis of spatial and non-spatial data of climate, water, agriculture and socioeconomic areas

4

Fourth chapter discuss the Intergovernmental Panel on Climate Change (IPCC) vulnerability assessment and GP vulnerability scores based on degree of vulnerability through sensitivity and adaptive capacity in 4 areas

5

Fifth chapter explores key water actions under Mahatma Gandhi NRGES convergence and its proposed actions as developments in public and common land, agriculture and allied sectors, rural infrastructures and climate resilient measures

7

Seventh chapter provides the process of GP plan implementation, its integration in to Mahatma Gandhi NRGES soft and about NRM and Non NRM works progress

6

Sixth chapter sketches the projected outcomes of planning and development in public and common land, agriculture and allied sectors, rural infrastructures and its linkage with NDC and SD goals

8

Eighth chapter provides model case study on one micro water shed and GP from the Block to illustrate how CWRM planning processes unfolds into analysis, results and impacts from macro-watershed to the lowest planning unit GP

9

Ninth chapter concludes with the significance of Block level study and recommendations

துப்பார்க்குத் துப்பாய துப்பாக்கித் துப்பார்க்குத்
துப்பாய தூஉம் மழை

குறள் - 12

The rain begets the food we eat
And forms a food and drink concrete

Thirukkural - 12

CHAPTER 1

1 ABOUT THE BLOCK

Thiruppullani is one of the coastal Blocks of Ramanathapuram District which lies between 9°12'23.189"N to 9°24'22.738"N latitude and 78°40'30.763"E to 78°56'3.607"E longitude. This Block has long coastal stretch in East side along the Bay of Bengal and surrounded by Mandapam, Ramanathapuram, Kamudi, Bogalur, and Mudukulathur Blocks (Figure 1.1). The total geographical area of Block is 28,890 ha (288.90 Km^2). Administratively, this Block comes under Ramanathapuram taluk, and it has 33 Gram Panchayats with 240 hamlets.

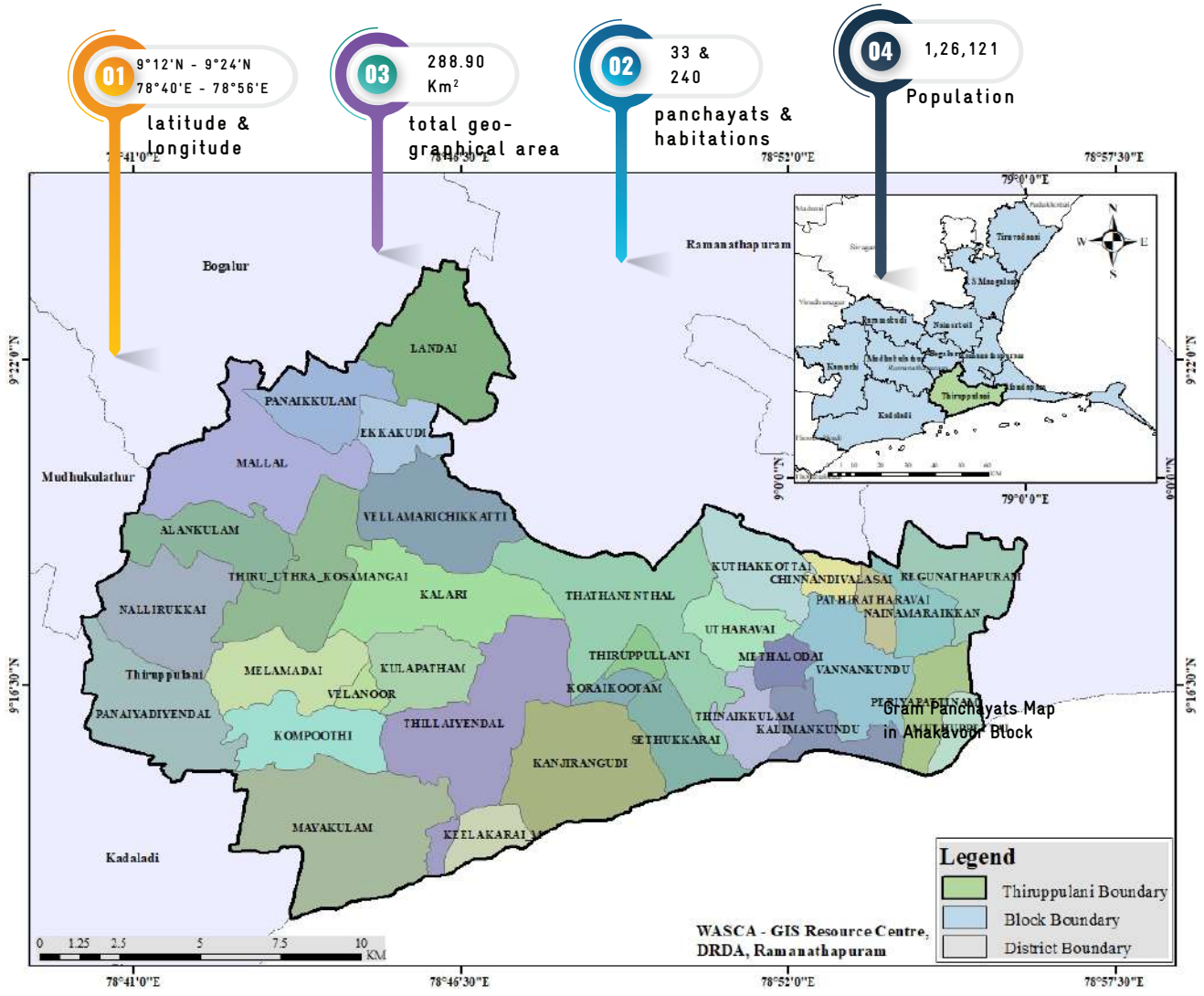


Figure 1.1. Thiruppullani Block and it's environ

According to Census 2011, the population of the Block is 1,26,121. The population density of the Block is 437 per Km^2 which is much higher than the district (331Km^2) and State's density (555 Km^2). The population growth has increased in the last decade with an increase of 6.85% in population, observed since 2001. The proportion of sex ratio is 949 females for 1000 males. The average literacy rate of this Block is 81.96 % which is much higher than the national average (72.98%). The male literacy rate is high (87.70%) than female literacy rate (75.90%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 17.80% of the total population. Economically, this urban Block has high employment opportunities with high secondary and tertiary sectors growth rate. According to the State Planning Commission, Government of Tamil Nadu's Human Development Report – 2017, 19.88 % families are in below poverty line (BPL). The % of BPL families are low in this Block and less than that of district BPL status. People of the Block are dependent on the coastal ecosystem, allied activities such as fishing, aquaculture, salt pan are high along the coastal GPs. Fishing is a major livelihood of this Block, giving huge profits for the Block and district. Majority of the area of the Block is rainfed. Paddy is the

> The proportion of sex ratio is 981 females per 1000 males, which is lower compared to the district average (994 females per 1,000 males)

> average literacy rate of the Block is higher (74.06%) than national average (72.98%)

major crop, and other major crops under irrigation are oil palm, coconut and dry chilli. Paddy is cultivated both under rainfed and irrigated conditions. Other major cultivation under rainfed conditions is dry chilly, sesame, coriander and sugarcane. This Block has two agriculture go downs for storage purpose. Apart from agricultural activities, around 800 families are involved in making Palm Leaf handicrafts. Dairying, sheep rearing and poultry is also visible with 2 milk societies and 23,040 liters of milk being produced in the Block. Thiruppullani is famous for an ancient temple dedicated to Athi Jaganatha perumal and Sethulkarai, a pilgrimage centre. Thiruppullani is also one of the Blocks to be covered under the Tamil Nadu Rural Transformation Project (TNRTP), which is a world bank initiated project aiming to create an enabling environment for rural enterprises across select value chains.

> nearly 71% of irrigated area are cultivated with paddy

Hydrologically, Thiruppullani Block lies in Vaigai and Gundar basin and lower Vaigai and Uthirakosamangai sub basins covers the Block (Figure 1.2).

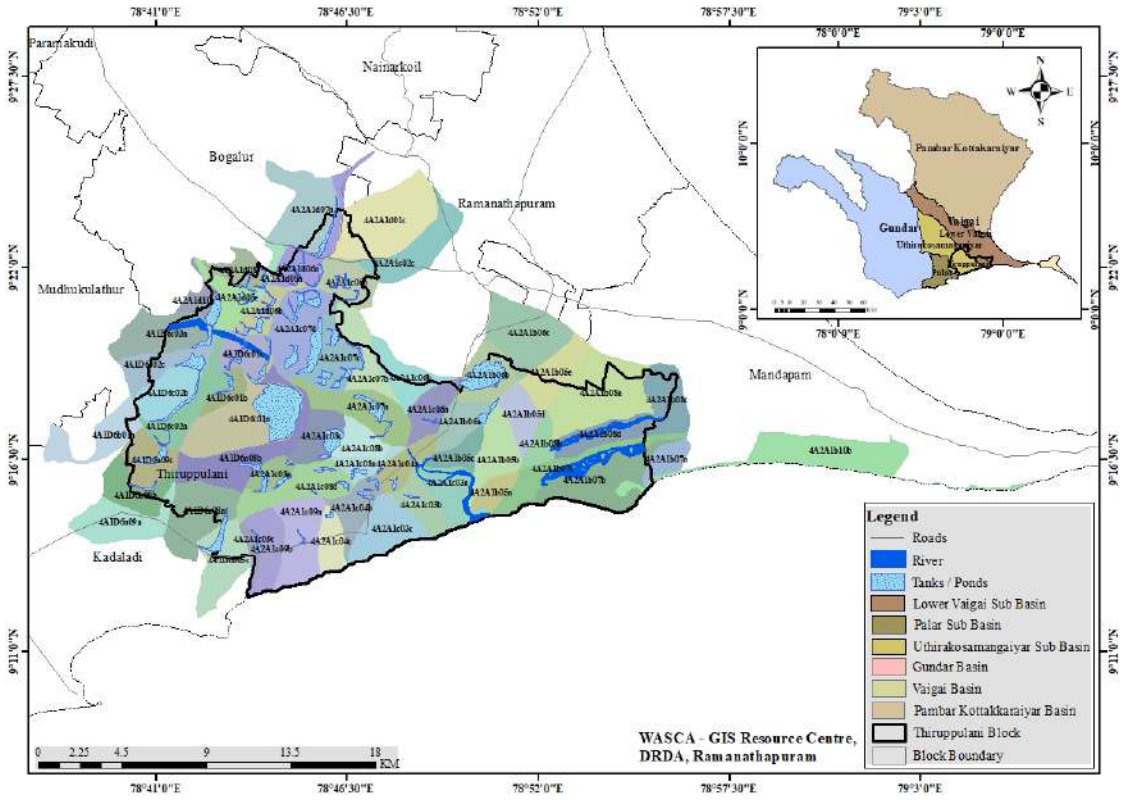


Figure 1.2. Watersheds – Thiruppullani Block

Situated in rain shadow area, Ramanathapuram district had the extraordinary tank irrigation system which was built hundreds of years ago. The tanks were designed in such a way that the outflow from one tank would serve as the inflow for the next tank after it has reached its capacity, allowing the excess water to flow out into the next tank. Water harvesting structures 'Ooranis' also play a huge role in groundwater conservation and recharge, guaranteeing availability of safe drinking water and useful for farmers who do not have water source for irrigation or find it expensive. There are 79 major and minor tanks in this Block, 5 Ex zamin MI tanks, 52 Panchayat MI tanks, and 22 PWD tanks (Human Development Report 2017). Figure 1.3 shows the spatial distribution of water bodies in this Block. Three firkas namely Thiruppullani, T.U.Mangai and Keelakkarai cover the Block, in which Thiruppullani firka is saline and T.U.Mangai and Keelakkarai firkas are safe in ground water development (CGWB's ground water assessment report 2017).

GROUND WATER LEVEL OF THIS BLOCK

SALINE - >100%	Thiruppullani
SAFE - <70%	T.U.Mangai, Keelakkarai

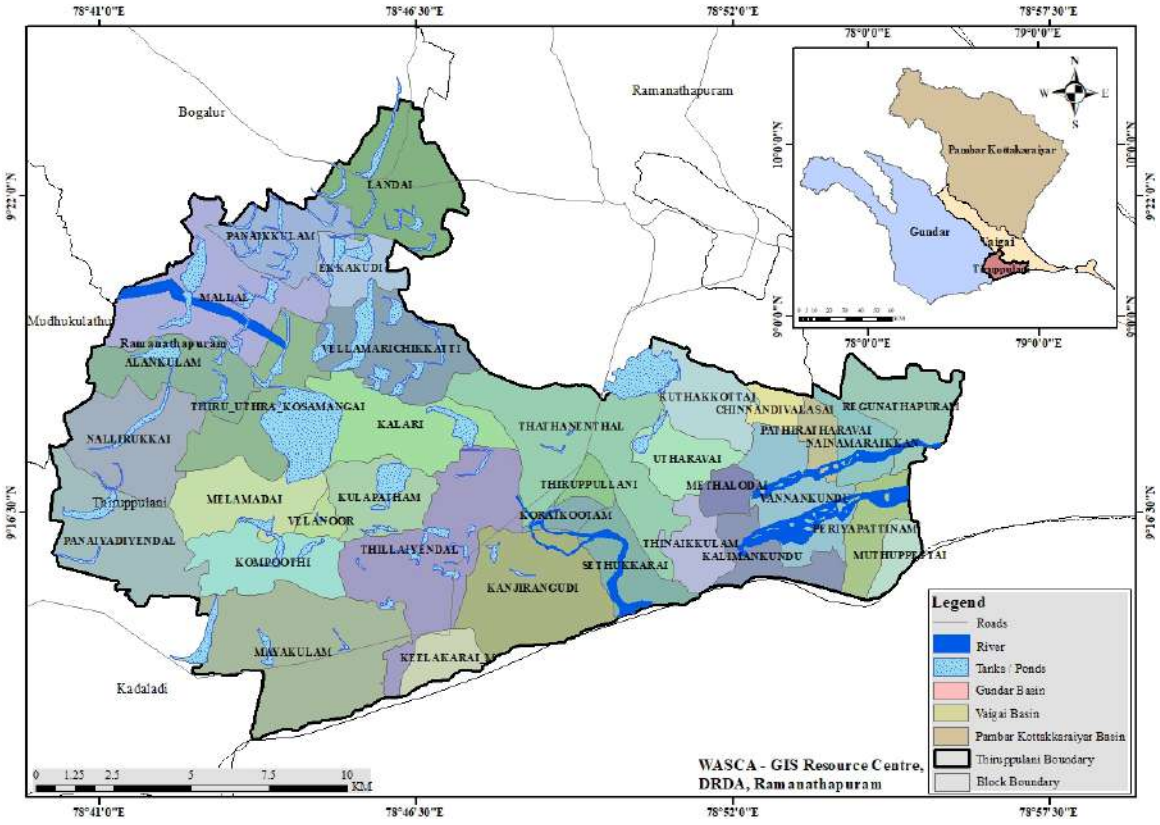
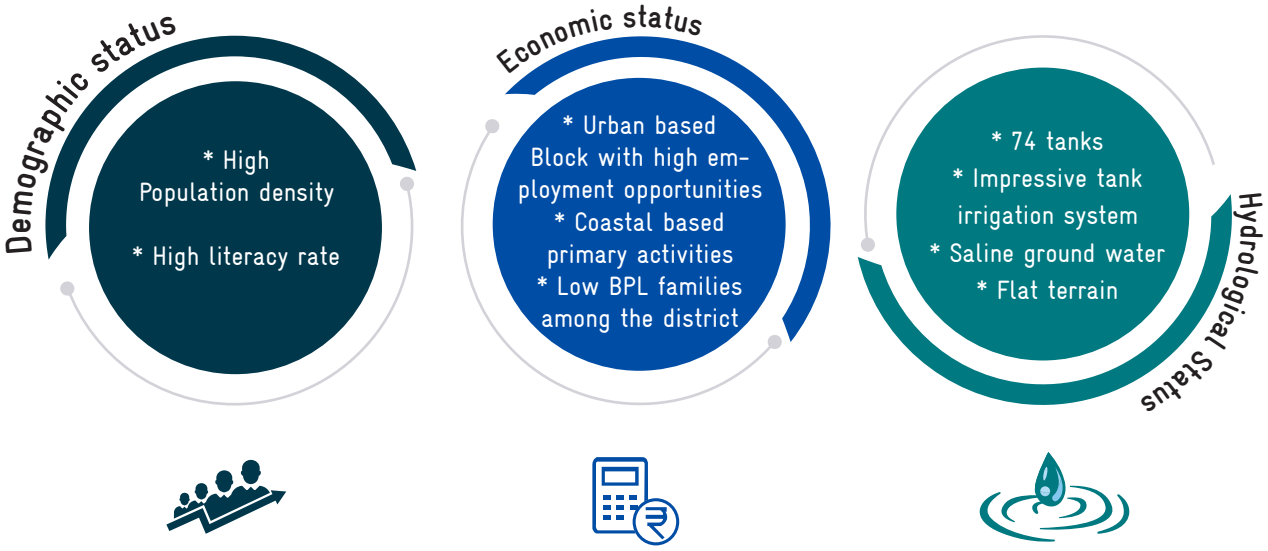


Figure 1.3. Spatial distribution of waterbodies



வின்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

Let clouds their visits stay, and dearth
Distresses all the sea-girt earth

Thirukkural - 13

CHAPTER 2

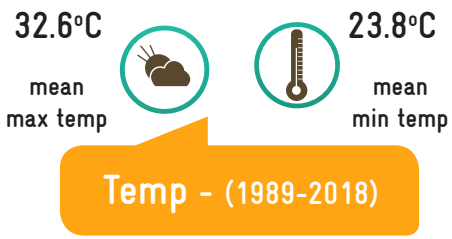
2 CLIMATE AND WATER SECURITY

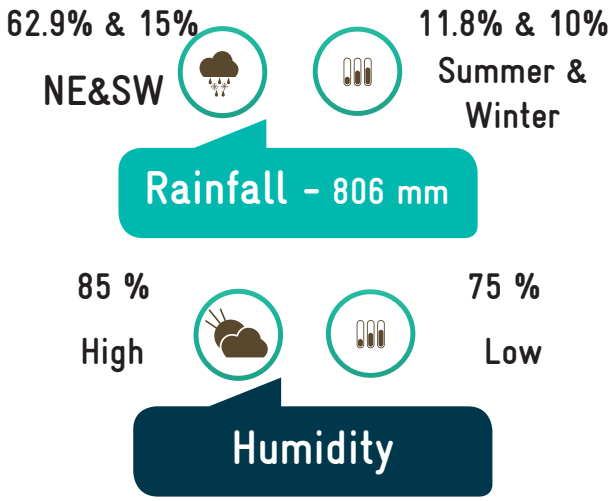
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of planning commission. The general climate description of this region is given below (Table 1).

TABLE 1. GENERAL CLIMATE DESCRIPTION

Agro-climatic Region*** (Planning Commission)	Agro-climatic Zone*** (NARP)	Agro Ecological Sub-Region*** (ICAR)
East Coast Plains and Hill Region (XI)	Southern zone (TN-5)	Hot dry semi-arid eco sub region(18.1)
Temperature	**Rainfall**	**Humidity**
32.6 to 23.8 °C	806 mm	75- 79 %

In general, this semi-arid region has dry and hot weather. The mean maximum temperature is 32.6°C and mean minimum temperature is 23.8°C during last 30 years (1989-2018) (IMD). In summer months the maximum temperature goes up to 45°C for fewer days. The monthly average temperature characteristic during June 2018 to May 2019 are shown in Figure 2.1.





The annual rainfall of this region is 806 mm (IMD) which is less than State's average rainfall. Normally this region receives major rainfall from North East Monsoon (NEM) (October to December) followed by South West Monsoons (SWM) (June to September), winter and summer (April to months. NEM contribute a maximum of 62.9 % (507.4mm) of the total annual rainfall and SWM contributes 15% (121.7mm). This region normally receives accountable rainfall during Summer (March to May) and winter (January, February) months too. Summer rainfall accounts 11.8 % (95.5mm) and winter season accounts 10% (82.2) to the annual rainfall (WRIS,

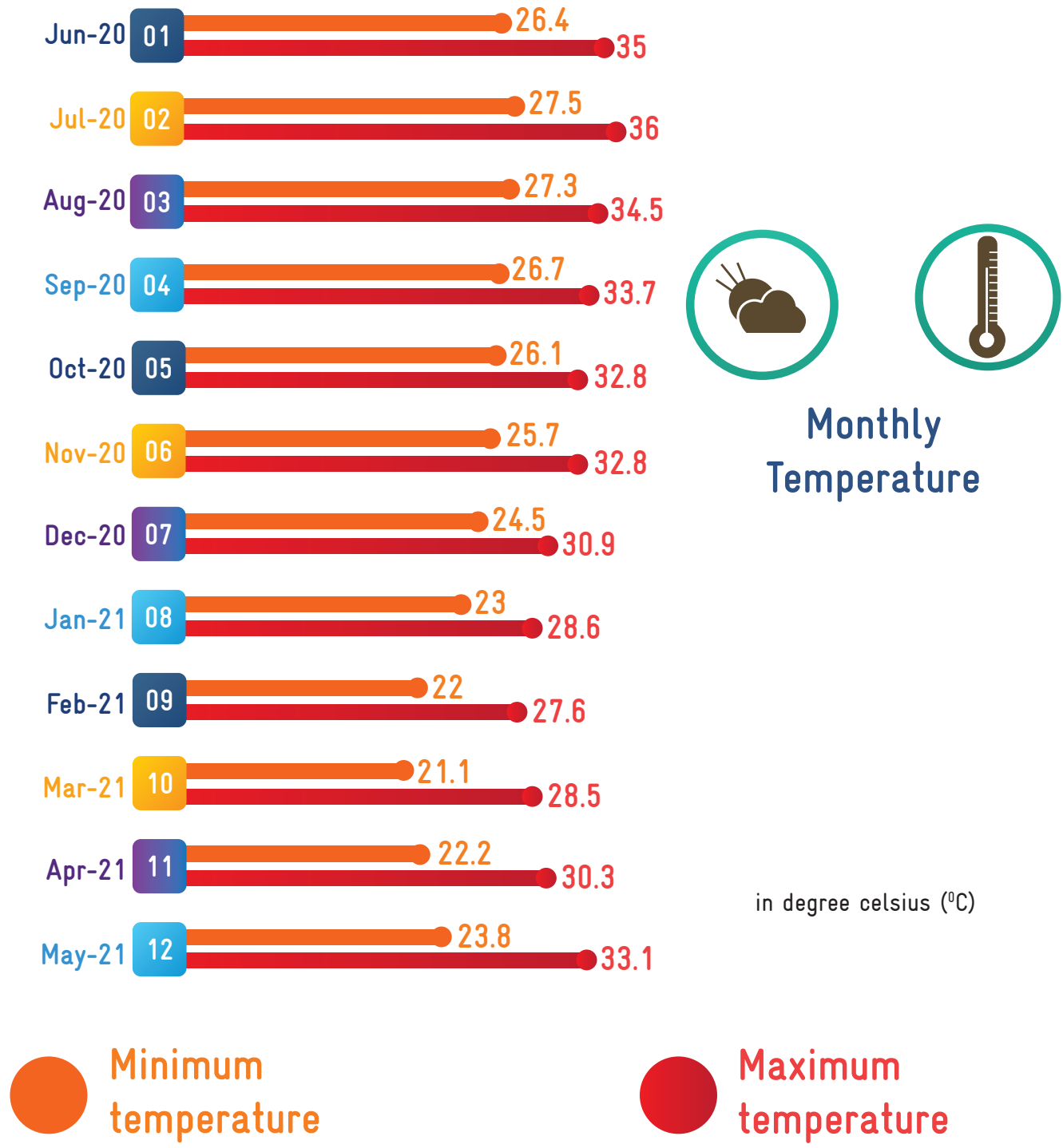


Figure 2.1. Monthly average maximum and minimum temperature

GoI) (Figure 2.2). The average annual rainfall days are 107 days in which a majority of 84 days are from NEM. Next to NEM, summer months have major rainy days as 10 followed by 9 days in SWM and 4 days in winter months. Onset of NEM rainfall starts in the first week of October and cessation is at fourth week of December. In general, the humidity percentage ranges between 75% to 79%. the highest relative humidity percentage of 85% is recorded during month of November and the lowest relative humidity percentage of 75% is recorded during month of May in this southern zone.

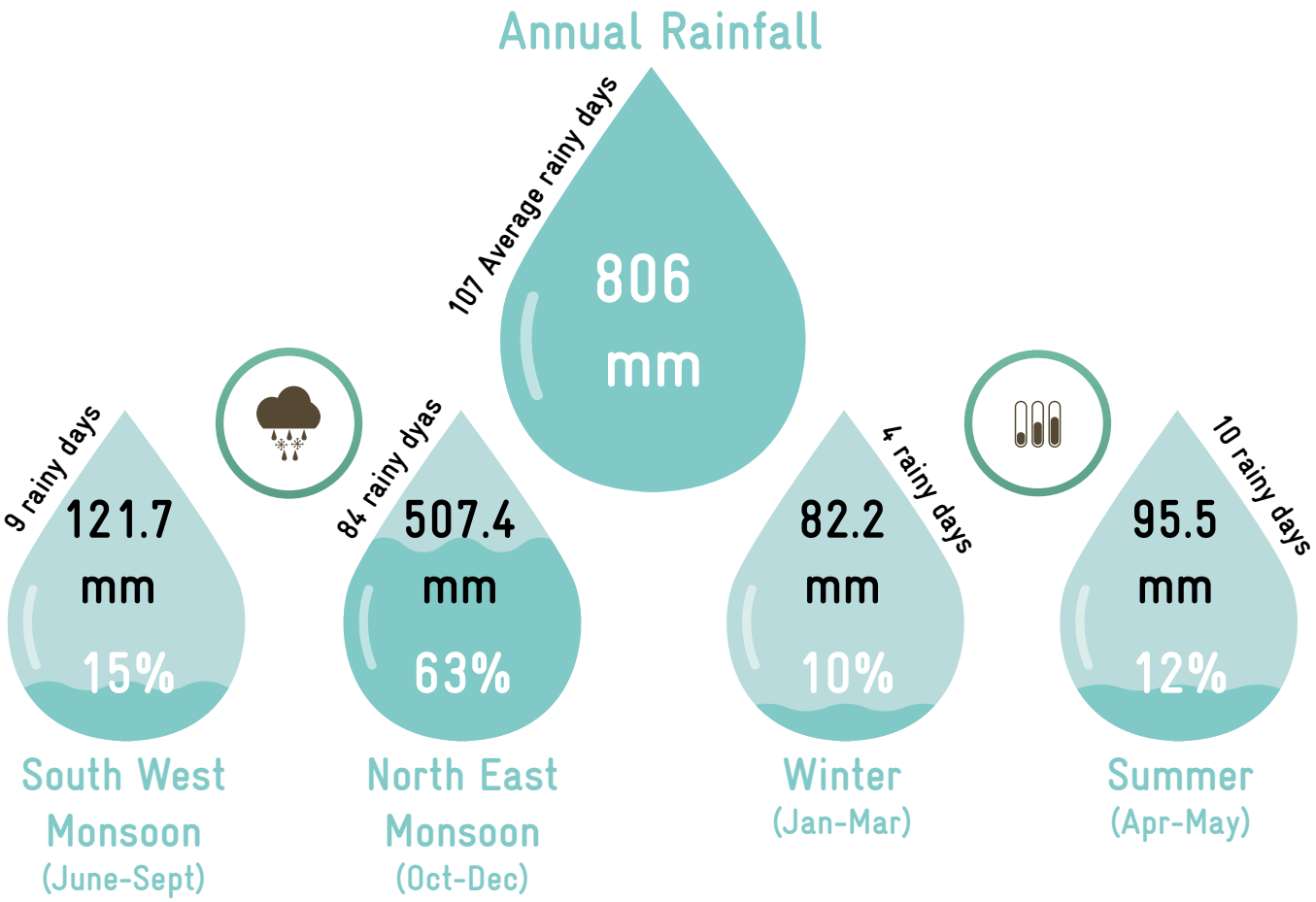


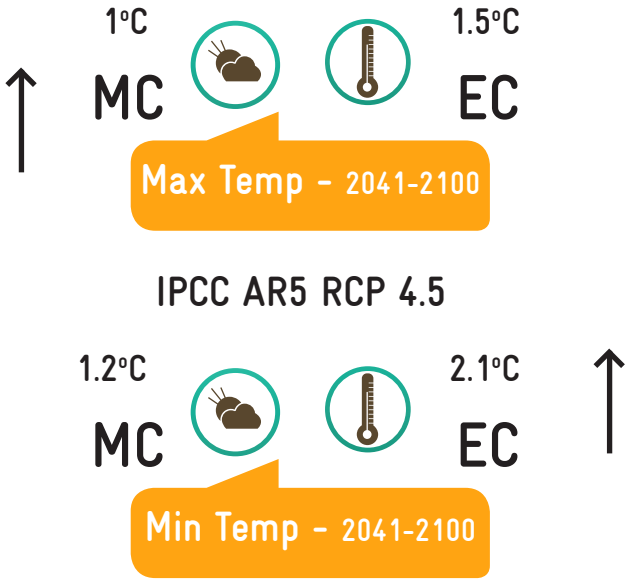
Figure 2.2. Season wise distribution to annual rainfall

In recent decades, the world is witnessing significant changes in its climate. These changes include increase in average temperature, variations in the rainfall intensity and its frequency. This region is also no exception, and 1.4^{0}C and 0.4^{0}C increase in maximum and minimum temperature was observed during 1951 to 2015 (IMD). The rainfall variability is also well observed. During 1951 to 2015, 18 deficient rainfall years (below normal rainfall) were recorded. The deficient rainfall years are highest among rest of the districts of Tamil Nadu. The consecutive deficient rainfall leads to severe drought, since this region is heavily dependent on NEM monsoon rains alone. As rainfall is the major source for determining water storage, existing water resources, major and minor tanks fail along with deficient rainfall years.

The continuous assessment reports of Intergovernmental Panel on Climate Change (IPCC) alarmed that the changes in climate have a key role in intensifying and triggering extreme events, such as floods, droughts, heatwaves, and tropical cyclones, which are all likely to increase in the future also.

Recent IPCC Assessment Report 6 (AR 6) outlines that climate changes will increase in all regions of the globe over the coming decades and that even with 1.5°C of global warming, there will be increasing heat waves, longer warm seasons, and shorter cold seasons – which will become more intense at 2°C of warming.

Climate projection based on global climate models indicated that there would be 1.1°C increase in maximum temperature in mid-century (MC) period (2041-2070) and 1.9°C increase in end-century (EC) period (2071-2100) from the baseline scenario under RCP 4.5 climate scenario in this region. The minimum temperature would increase nearly 1.3°C and 2.2°C during MC and EC periods. Average annual rainfall for IPCC AR5 RCP4.5 scenarios is projected to increase about 1 percent towards MC to EC period.



The observed and projected climate changes will have serious impacts in the areas of

* surface and ground water availability
* water quality
* soil moisture
* evapo-transpiration
* sea water intrusion

* 1.4°C increase in maximum temperature during 1951-2015
* 0.4°C increase in minimum temperature during 1951-2015
* 1.5°C increase in max temp during 2041-2070 (RCP4.5)
* 1.9°C increase in max temp during 2071-2100 (RCP 4.5)

Being a water scarce and drought prone region coupled with saline ground water, the changes in climate pose severe threats to dependent sectors such as agriculture and allied activities, industry, and livelihoods of people, particularly the vulnerable sector.

2.1 CLIMATE RISKS

Increasing temperature, fluctuating rainfall patterns and its extremities creates shorter rainy seasons and longer dry seasons making the river basins more vulnerable. This district experiences frequent droughts, cyclones, floods, and storm surges. Being a coastal district, sea level rise is also a distressing issue under the changing climate scenario.

* Frequent Droughts
* Cyclones
* Storm surges up to 6m
* Soil erosion
* Flood inundation
* Sea level rise

Drought

Generally, this rain shadow region has a prolonged dry climate. Majority of lands are rain fed which depends on monsoons especially NEM. Thus, frequent and consecutive monsoon failures (received less than 40% of normal rainfall) coupled with the erratic behavior of the monsoon makes the district more vulnerable to droughts. This district experiences drought once in 3 years which impacted the ground water levels, reservoir levels, crop conditions, and soil moisture. Sandy soils in the region are more prone to severe drought. The district experienced consecutive droughts in recent decades particularly in 2003, 2009, 2016, 2017 and 2019. All parts are affected by drought and its consequences; there are large area crop losses and drinking water scarcity.

Flood

Though it is a low rainfall region, it experiences heavy rain and flood during deep depressions/cyclones forms in the Bay of Bengal. State Disaster Management Authority (SDMA), Government of Tamil Nadu has identified 39 locations of Ramanathapuram district as flood vulnerability of medium category (inundation of water from 2 to 3 feet) based on past events (Ramanathapuram District Disaster Management Plan 2020-2021). Out of this 39 locations, 1 location is in Thiruppullani Block.

Cyclones

A tropical cyclone is a multi-hazard weather phenomenon, as it leads to heavy rainfall, gale wind and storm surge during the landfall. The winds, heavy rainfall and storm surge associated with the cyclone result in flooding of coastal areas, erosion, saline intrusion, loss of life, property, belongings, disruption of communication facilities, damages to agricultural and plantation crops and livestock etc., Being a coastal region, this district faces hazard due to cyclone forms in Bay of Bengal. The 1964 Rameswaram cyclone was regarded as one of the most powerful storms to ever strike India on record and worst to hit the district. In recent years, some of the tropical cyclones such as Burevi (2020), Gaja (2018) cyclones had its impacts here. This district also experiences storm surges exceeding 6m above the concurrent sea level. IMD, High soil erosion is also noticed here. Ministry of Earth Science, Govt. of India, prepared Cyclone hazard proneness of districts based on frequency of total cyclones, total severe cyclones, actual/estimated maximum wind strength, Probable Maximum Storm Surge (PMSS) associated with the cyclones and Probable Maximum Precipitation (PMP). The report indicates Ramanathapuram district is highly prone (Cyclone warning in India, IMD, March 2021).

Sea level rise

Sea level rise (SLR) is one of the greatest challenges of the low-lying coastal regions of the world. Recent Intergovernmental Panel on Climate Change (IPCC) 2021 report cautioned that there The average rate of SLR was 1.3mm/yr (1901-1971) and rose by 03.7mm yr (2006-2018), and it would continue to rise to 2 m by the end of the Century under a very high emissions scenario (SSP5-85 low confidence) (IPCC, 2021). IPCC cautions that coastal areas will get continued SLR throughout the 21st century, contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion. This coastal region will also face sea level rise and future SLR projection studies indicates there would be 4.51 cm (low range)/ 7.21cm (medium range) increases for the year 2025 and it would be 30.29 (low range), 49.10 cm (medium range) under IPCC AR5-RCP 4.5 scenario (CCCDM, Anna University). In Ramanathapuram district, about 180 coastal habitations are identified for coastal vulnerability based on their distance from sea shore, soil erosion, saltwater intrusion (Ramanathapuram District Disaster Management Plan 2021-2022). Out of this 180 habitations, 37 habitations are in Thiruppullani Block and are considered in this study for the vulnerability assessment.

2.2 WASCA CLIMATE VULNERABILITY INDICATORS

During 2019, WASCA TN conducted preliminary State level scoping study on the State's rural water security through the lens of climate and identified climate and water security hotspots/potential geographical areas for project demonstration through scientific criteria, jointly with the Centre for Climate Change and Disaster Management (CCCDM), Anna University. The vulnerability of a region to the climate depends on several intrinsic factors such as physical, social, economic, and environmental conditions. On the basis of the ground reality and accurate observations, WASCA TN study proposed 18 indicators to reflect the State's rural water security through four interconnected CWRM areas viz., climate extremities, water resources, agriculture and socio-economic to assess climate-water vulnerability at the district level (Table 2).

TABLE 2. BIOPHYSICAL AND SOCIO-ECONOMIC INDICATORS USED IN VULNERABILITY ASSESSMENT

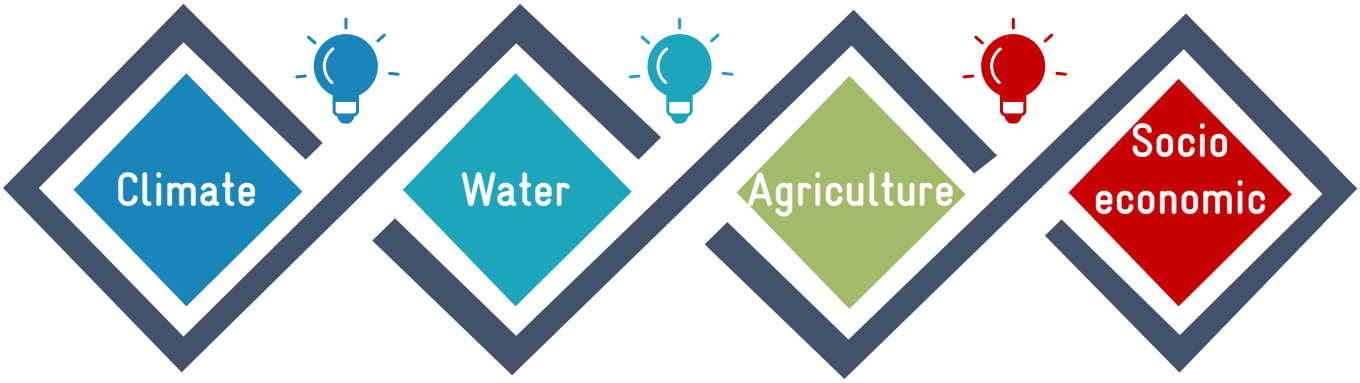
CWRM Area	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (^{O}C)	C1	Goal 13
	Changes in min temperature (^{O}C)	C2	Goal 13
	Changes in rainfall (%)	C3	Goal 13
	Excess rainfall years	C4	Goal 13
Water	Deficient rainfall years	C5	Goal 13
	Ground water extraction (%)	W1	Goal 6
	Ground water Recharge (m3)	W2	Goal 6
	Surface water availability (mm)	W3	Goal 6
	Water gap (mcm)	W4	Goal 6
	% of contamination	W5	Goal 6
Agriculture	Rainfed area (%)	A1	Goal 15
	Cropping intensity (%)	A2	Goal 2
	Soil moisture (Kg/m2)	A3	Goal 15
	Evapotranspiration (Kg/m2)	A4	Goal 15
Socio-economic	Rural proportion (%)	S1	Goal 2
	Multidimensional poverty index	S2	Goal 1
	Source of drinking water within premises in rural (%)	S3	Goal 6
	Marginal farmers land holdings (%)	S4	Goal 1

Data for these 18 biophysical and socio-economic indicators were collected at the district level and categorized into exposure, sensitivity and adaptive capacity for the analysis. The vulnerability ranking was given based on IPCC protocol of vulnerability assessment methodology. Based on the analysis, Tiruvannamalai and Ramanathapuram districts were selected by the State Level Steering Committee headed by the Secretary RD&PR in Nov 2019 for implementing the WASCA. Subsequently, all the key water actions, CWRM planning and implementation works were envisaged for the above two districts through these influencing indicators collectively under four CWRM areas viz. climate, water, agriculture and socio-economic.

2.3 COMPRESSIVE ANALYSIS OF BLOCK LEVEL VULNERABILITY

WASCA TN has progressed towards Block level climate vulnerability mapping in order to strengthen water resources and build context specific climate resilient models at GP level. The 18 vulnerability indicators at district level under four areas via climate, water, agriculture and socio-economic are further explored at the GP level through Composite Water Resource Management (CWRM) approach by GIZ, Department of Rural Development (Mahatma Gandhi NREGS), National Water Mission, Tamil Nadu along with three technical partners of WASCA project Viz., MS Swaminathan Research Foundation (MSSRF), Sugandhi Devadasan Marine Resources Institute (SDMRI), Prime Meridian and key sectoral experts. Based on the national level workshop on WASCA for GIS based planning using IWRM principles, a Composite Water Resources Management plan framework was customized to suit to Tamil Nadu State's conditions, including climate vulnerability as per the scoping study recommendations, Major CWRM parameters were thus identified under four areas via climate, water, agriculture and socio-economic for advancements towards actions. The major parameters identified at Block level (Table 3) are collected both from primary and secondary sources and analyzed statistically and geospatially.

TABLE 3. MAJOR PARAMETERS IDENTIFIED FOR BLOCK LEVEL VULNERABILITY ASSESSMENT



Climate	Water	Agriculture	Socio economic
Drought, Locations based on past disasters and vulnerability	Watershed and drainage network, traditional water bodies, canal networks, irrigation facilities, catchments area wise available runoff, ground water and surface water utilization, ground water status, ground water availability, evapotranspiration losses, and water demand for drinking, agriculture and livestock, water quality, sea water mixing and salinity	Land resources, land use under different categories, catchment area, means of water extraction, irrigation methods, crop details, status of soil resources including macro and micro nutrients, soil physical condition, soil moisture, and livestock details	Area, population, gender, vulnerable population and household, details of MGNREGA job seekers, drinking water sources and grey water generation

ஏரின் உழாஅர் உழவர் புயலென்னும்
வாரி வளங்குன்றிக் கால்

குறள் - 14

Unless the fruitful shower descend
The ploughman's sacred toil must end

Thirukkural - 14

CHAPTER 3

GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

3 GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

WASCA, GIZ has evolved a GP based CWRM planning approach for facilitating convergent planning under Mahatma Gandhi NREGA as per the recommendations of National Level Workshop organized by MoRD, MoJS, GIZ along with State rural development department of WASCA implementing states in February 2020. While developing the framework, inputs from all the relevant stakeholders including communities, public institutions, civil society, research organizations, and private agencies were taken into consideration. Both Annual Master Circular issued by MoRD during 2021-22 and Annual Planning Circular issued in September 2020 focused on developing GIS based planning in all Gram Panchayats. The planning exercise for Mahatma Gandhi NREGS will be a part of the convergent planning exercise for the Ministry. The thrust is on planning for works related to Natural Resource Management (NRM), agriculture and allied activities and livelihood related works on individual's land leading to sustainable livelihoods as well as provisioning of livestock shelters for the individual households. The NRM related works under Mahatma Gandhi NREGS shall be taken up in convergence with Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Integrated Watershed Management Programme (IWMP) and Command Area and Water Management (CAD&WM) schemes for better outcomes of the water conservation and water harvesting measures. Technical inputs for planning shall be drawn from the technical resources available in the district under Mahatma Gandhi NREGS, CSO partners and other line department agencies. In case of planning for NRM works, the technical inputs will be drawn from the joint pool of technical personnel of IWMP in Watershed Cell cum Data Centre (WCDC), Mahatma Gandhi NREGS unit, Water Resource Department and the Agriculture Department. The technical inputs relating to Excavation, Renovation & Modernization (ERM)/ water bodies may also be sought from Regional Office of Central Ground Water Commission (CWC). The Gram Panchayats, while deliberating and finalizing prioritization of shelf of projects, will keep Macro and Micro-watersheds of 500-1000 hectares that often comprise 1-10 Gram Panchayats, in perspective.

The special focus on vulnerable households and communities are considered while preparing estimates for anticipated demand, list of works on individual land, and list of other works that provide direct individual benefits. The Convergent Planning Exercise shall make use of automatically included and deprived Households of SECC to ensure full coverage of poor and vulnerable households. Infrastructure built under Mahatma Gandhi NREGS leads 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 NREGS 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.

262

Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182

Kinds of works relate to NRM alone

164

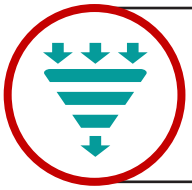
Kinds of works related to Agriculture and allied works

85

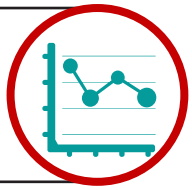
Water related works out of NRM

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 Agriculture and 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 manner. To facilitate evidence based scientific NRM planning process, 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 GIS Technology (BHUVAN). The GIS plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner. Section 22 of Annual Master Circular provides key steps for GIS based planning.



The GIS-based plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner



3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

CWRM approach for Water Security and Climate Adaptation uses simple scientific tools that can help Block or GP level officer to organize, analyze and prepare a draft plan for participatory discussion at Gram Panchayat level. This approach involves analyzing key water challenges using both non-spatial and geo-spatial data in GIS (Geographical Information System) coupled with extensive ground truth verification. The non-spatial data includes socio-economic, climatic, hydrological, edaphic and agricultural areas which are concurrently used for analysis along with the spatial data obtained from remote sensing in GIS platform. It starts with mapping of the administrative (habitations/panchayat/revenue village, Block/ taluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping Gram Panchayat as the lowest unit of planning and execution. Following this, a detailed socio-economic profile was mapped covering male/female population, proportion of SC and ST population, vulnerable households, access to employment in Mahatma Gandhi NREGS and proportion of works carried out in the village through amount of budget utilized as well as actual works completed. The climatic parameters including maximum and minimum temperature, season-wise rainfall and rainy days, evapotranspiration and soil moisture are used to understand the climate related issues. Then land use, watersheds, drainage networks and surface runoff, existing water supply and storage systems, water management for the key sectors and water demand are assessed and prepare the water budget for the GP (Box 1).

BOX 1. MAJOR COMPONENTS INVOLVED IN CWRM PLANNING WORKOUTS

a. Spatial and non-spatial data collection
b. Spatial data: Bhuvan (NRSC) & WRIS
c. Non-spatial data(Secondary): Govt. sources(published)
d. Non-Spatial data(Primary): Govt. records local level

a. Analysis of water from supply and demand side
b. Water budgeting: Surface & ground water
c. Status of soil moisture availability
d. Status of evapo-transpiration losses

a. Works and its impact on augmenting Water
b. Works and its impact on conserving water
c. Works and its impact promoting efficient use of water ·Block level

a. Identification of Key water challenges at GP level
b. Identification of location specific actions at GP level
c. Integration actions at block, sub-basin and district level
d. 261 list of works under Mahatma Gandhi NREGS and
e. List of Works -under various schemes

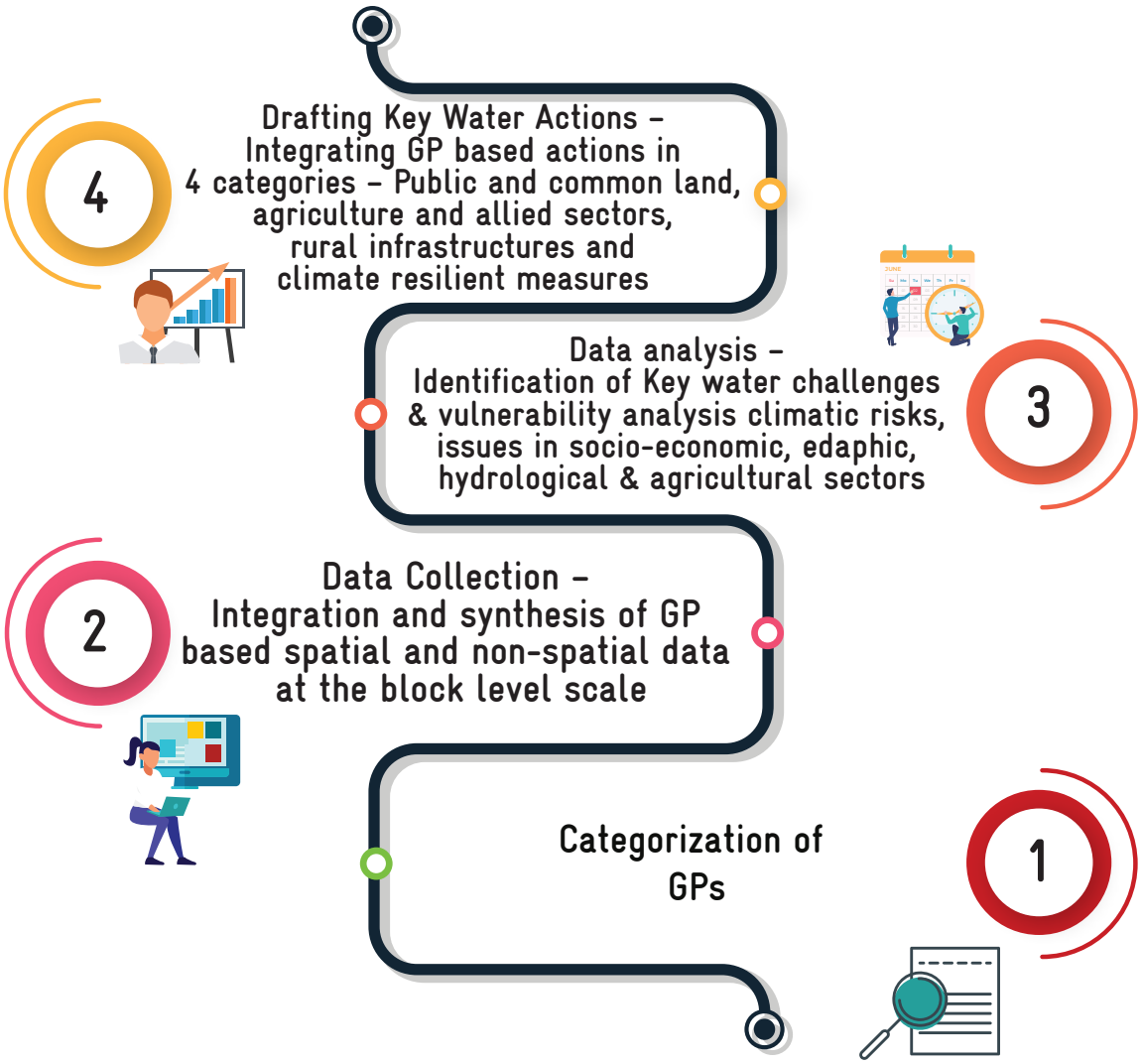
a. Block level
b. Watershed level & Sub-basin level
c. District level and
d. Baseline for assessing the impact

a. Verification
b. Community consultation
c. GP Approval
d. Integration to NREGA software
e. AS and TS

Such a comprehensive analysis in preparing the water budget integrating ground water, surface water through runoff from rainfall, evapotranspiration and soil moisture helps to identify potential areas of action to augment the water resources in public and common land, agriculture and allied sectors and rural infrastructure dimensions. The analysis also helps to understand the areas of interest and appropriate climate resilient measure as an adaptive measure to the emerging climate change scenarios. The water challenge linked water actions are the key in developing the perspective plan for the water secured GPs, serve as shelf of projects. These shelf of projects are again mapped with available schemes and financial plans for execution adopting convergence and inter-sectoral principles. In the execution process the district level technical and administrative teams are involved in planning, monitoring and evaluation in terms of outcome/impact mapping. In the execution stage, the approach of saturation of works, planning at watershed approach (ridge to valley), convergence is some of the key aspects which needs attention for a tangible outcome in both natural resource management as well as livelihoods.

The district WASCA resource centers established in the project area, facilitates this whole process for planning and implementation. This comprehensive and integrated approach has been accepted nationally and by state governments as a comprehensive and climate adapted planning approach for water security. The whole process has been categorized in to four stages – pre planning, planning, review and verification and integration and approval (Box 2).

STEPS INVOLVED IN BLOCK LEVEL ANALYSIS THROUGH CWRM APPROACH



This integrated approach has been accepted Nationally and by State and District Level Steering Committees headed by Additional Chief Secretary RD&PR and District Collectors respectively in the project area of Tamil Nadu State government as a comprehensive and climate adapted planning approach for water security under Mahatma Gandhi NREGS and National Water Mission.

BOX 2. MAIN STAGES OF CWRM PLANNING PROCESS

PRE-PLANNING STAGE

1. Categorizing Villages for planning as per Mahatma Gandhi NREGS guidelines
2. Identification of GP, Block, District officers for planning facilitation
3. Capacity Building of officers at State, District implementing Mahatma Gandhi NREGS
4. District specific CWRM framework and indicators suitable to the terrain and geography
5. Identification of Phases for pre pilot GPs for planning (4 GP Plans per Block) as per DLSC and SLSC

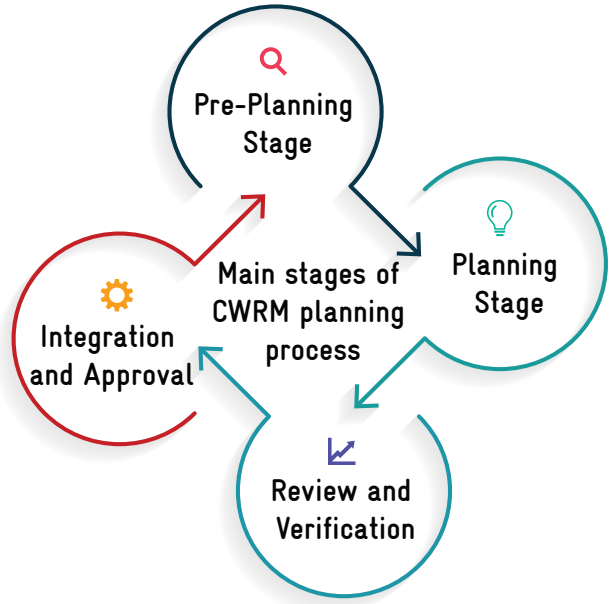
PLANNING STAGE

1. Collection on Non-Spatial statistical data as per MoRD guidelines and CWRMP
2. Collection of Spatial as per MoRD guidelines and CWRMP
3. Water Budget Estimation (CWRMP)
4. Conducting district specific studies on Ground Water Assessment as per CWRM
5. Inclusion on Non-NRM activities under Mahatma Gandhi NREGS with CWRMP
6. Identification of Key Water Challenges - CWRMP
7. Identification of Key Water Actions -CWRMP

FOUR LEVELS OF CWRM PLANNING UNDER WASCA

1. DEVELOPING PLANS AT LOWEST ADMINISTRATIVE LEVEL: GP LEVEL PLANS

2. INTEGRATING GP LEVEL PLANS AT BLOCK LEVEL



FOUR LEVELS OF CWRM PLANNING UNDER WASCA

3. INTEGRATING GP PLANS AT WATERSHED AND SUB-BASIN (CATCHMENT) LEVEL ON NATURAL RESOURCES

4. INTEGRATING GP PLANS TO DEVELOP WASCA DISTRICTS CWRM PLANS

INTEGRATION AND APPROVAL

1. Preparation of Integrated plans (Block, Watershed)
2. District Level WASCA Plan
3. Approval at GP level for preparation of Labour budget using CWRM frame work outcomes
4. Approval of District plan at DLSC as per above recommendations of GP level
5. Submitting approved District WASCA plan from DLSC to SLSC for financing and convergence

REVIEW AND VERIFICATION

1. Matching spatial data as per Mahatma Gandhi NREGA- MoRD guidelines on GIS based planning
2. Field Verification, GP level Meetings for inclusion in labour budget 2021-22
3. Approvals of verified works at GP by the Block and GP level officers implementing Mahatma Gandhi NREGS in the project area
4. Integrating verified, approved works into NREGA soft (MORD NIC Portal) for mainstreaming WASCA
5. Regular review on progress at all levels

3.2 CATEGORIZATION OF GPS

The CWRM uses both spatial and non-spatial data for developing GP level plans. Most of the non-spatial data are available at the revenue village level. To synchronize planning at GP, keeping data availability and administrative boundary for GIS planning, various GP's are categorized based on revenue village boundaries, for collecting and organizing the datasets. Based on the above factors, five different types of GPs are classified as Type I, II, III, IV and IV. The description on categorization of GP's is annexed (Annexure 1). Details of categorization of GPs in Thiruppullani Block is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF THIRUPPULLANI BLOCK GPS

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
12	GP and revenue village data and boundary match (Type-I)	Alankulam, Ekkakudi, Kalari, Kanjirangudi, Kompoothi, Kulapatham, Landai, Nallirukkai, Panaikkulam, Panaiyadiyendal, Uthrakosamangai, Vellamarichikkatti
18	Having more than one GPs in one Revenue Village (Type-II)	Chinnandivalasai, Kalimankundu, Koraikootam, Kuthakkottai, Melamadai, Methalodai, Muthupettai, Nainamaraikkan, Pathiratharavai, Periyapattinam, Raghunathapuram, Sethukkarai, Thathanenthal, Thinaikkulam, Thiruppullani, Utharavai, Vannankundu, Velanoor
3	One GP is falling under more than Type 1 one Revenue Village (Type-III)	Mallal, Mayakulam, Thillaiyendal

3.3 DATA COLLECTION

The CWRM planning framework has four vulnerability areas, integrating both non-spatial and spatial parameters with 18 indicators based on the IWRM and climate adaptation principles. The planning process comprises of the following dimensions in a scientific and organized manner to prepare a meaningful plan at the lowest administrative unit i.e. GP plans.

SPATIAL DATA

The spatial datasets are supportive evidence to understand the existing conditions and issues in the area/region. Considering the spatial datasets such as morphology, ground water potential, slope terrain, erosion, Land Use and Land Cover (LULC), waste land, salt and erosion affected lands, drainage lines, and slope will play a significant role in contributing to preparation of the most appropriate and suitable science-based decision plans towards holistic development of the region, emphasized with the water actions. The use of different spatial data to assess and confirm the key water challenges along with the non-spatial data is discussed below:

NON SPATIAL DATA

- Characterization of catchment landscapes based on the ten-fold land use classification to know available land area in both public and individual land ownership and its current position in terms of available area and use, its links with surface runoff as good, average and bad runoff.

- Watershed analysis to understand the hydrological and administrative boundaries, know the vulnerable and good micro-watersheds, its location, distribution of different land use within the micro-watersheds for planning relevant water actions

- Soil characteristics including the macro and micro nutrient status, physical quality of the land using pH values and textural soil quality to understand its permeability, infiltration and water holding capacity which are crucial for soil moisture content

- The agriculture and livestock datasets help in understanding the quantum of water requirement of the key crops and type of cropping systems adopted, number and type of different livestock resources and its water requirement vis-a-vis its linkage to livelihoods of the vulnerable population in the village

- Grey water generation at GP level to understand the quantum of grey water available and existing methods of its use. This information is essential to plan the effective strategies for recycle and reuse

- Water budgeting at GP level to demonstrate the sector wise water demand and available water through the traditional water harvesting and storage bodies and the potential runoff that can be conserved through appropriate actions on the supply side. The difference between demand and supply at the GP level helps the communities to understand the gap and practice the necessary water actions.

ASSESSMENT OF GROUND WATER QUALITY AND SEA WATER INTRUSION

The vulnerability of the groundwater quality, seawater intrusion in the aquifers were assessed and spatially mapped for the Ramanathapuram District. The water quality samples were collected from 380 locations throughout the district during pre-monsoon and post-monsoon season. The collected samples were analyzed using standard methodology for calculating Water Quality Index (WQI) and Sea Water Mixing Index (SMI). This data helps to identify the suitability of water for domestic purpose and to detect the concentration of major ionic constituents in seawater at GP level.

Over all, data from 102 parameters were collected, out of which 16 parameters are from primary source, collected from GP administrative units by GPs officers, 65 parameters are from secondary source, collected from Govt. sources and authentic websites and the remaining 21 requisite parameters for water budgeting and grey water were calculated using standards/suitable methods or formulas. CWRM parameters and its data sources is attached in the Annexure 3.1 to 3.3. The methods, and formulas used for water budgeting is attached in Annexure 3.4 and for grey water generation in Annexure 3.5. The water quality standards and formula used are in Annexure 3.6.

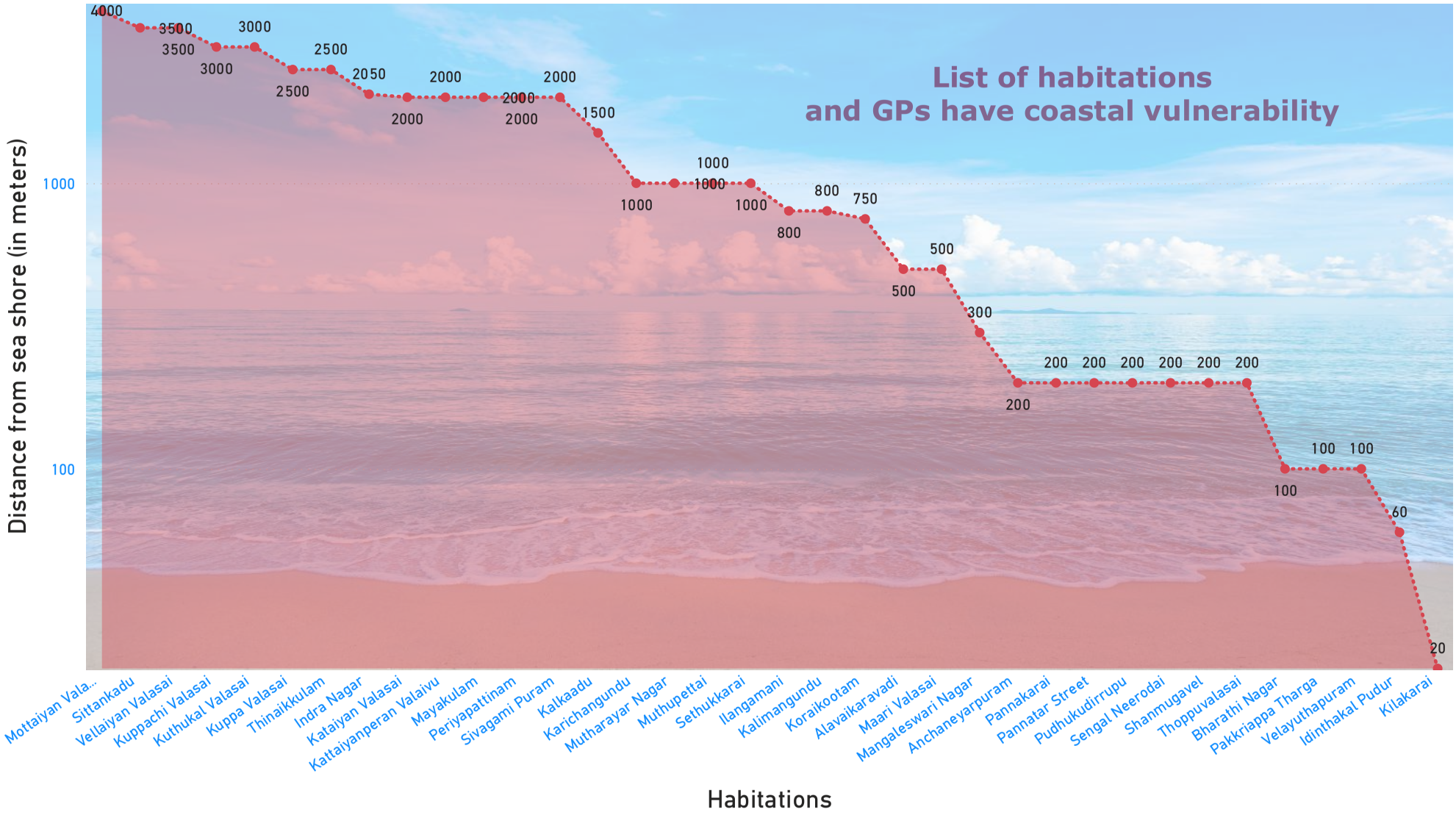
3.4 CWRM PLANNING ANALYSIS – CLIMATE

All the CWRM parameters are intended at Block level. On the other hand, all the climate change observations and projections are at district or regional level. Current data at the Block level is not available at present. Hence, previous hydro-meteorological disasters are considered to denote Block's flood and coastal vulnerability which was assessed by State Disaster Management Agency, 2020 are given in Table 5.

TABLE 5. CLIMATE RISKS AND VULNERABLE GP'S

LIST OF HABITATIONS AND GPS HAVE COASTAL VULNERABILITY

GP name	Habitations
Kalimangundu	Anchaneyarpuram, Kalimangundu, Kataiyan Valasai, Kuppa Valasai, Kuppachi Valasai, Kuthukal, Valasai, Maari Valasai, Shanmugavel, Thoppuvalasai, Velayutha-puram, Vellaiyan Valasai
Kanjirangudi	Alavaikaravadi, Idinthakal Pudur, Indra Nagar, Pakkriappa Tharga, Pannatar Street, Sengal Neerodai, Sivagami Puram
Keelakarai	Kilakarai
Koraikuttam	Koraikootam
Mayakulam	Bharathi Nagar, Mangaleswari Nagar, Mutharayar Nagar, Mayakulam
Methalodai	Mottaiyan Valasai, Sittankadu
Muthupettai	Muthupettai
Periyapattinam	Karichangundu, Periyapattinam, Pudhukudirrupu
Sethukkarai	Sethukkarai
Thinaikkulam	Kattaiyanperan Valaivu
Thinaikkulam	Thinaikkulam
Vannankundu	Ilangamani, Kalkaadu, Pannakarai


List of habitations
and GPs have coastal vulnerability
Distance from sea shore (in meters)
1000
100
4000
3500
3500
3000
3000
2500
2500
2050
2000
2000
2000
2000
2000
1500
1000
1000
1000
1000
800
800
750
500
500
300
200
200
200
200
200
200
200
100
100
100
60
20
Mottaiyan Vala...
Sittankadu
Vellaiyan Valasai
Kuppachi Valasai
Kuthukal Valasai
Kuppa Valasai
Thinaikkulam
Indra Nagar
Kataiyan Valasai
Kattaiyanperan Valaivu
Mayakulam
Periyapattinam
Sivagami Puram
Kalkaadu
Karichangundu
Mutharayar Nagar
Muthupettai
Sethukkarai
Ilangamani
Kalimangundu
Koraikootam
Alavaikaravadi
Maari Valasai
Mangaleswari Nagar
Anchaneyarpuram
Pannakarai
Pannatar Street
Pudhukudirrupu
Sengal Neerodai
Shanmugavel
Thoppuvalasai
Bharathi Nagar
Pakkriappa Tharga
Velayuthapuram
Idinthakal Pudur
Kilakarai
Habitations

3.5 CWRM PLANNING ANALYSIS – WATER

For effective planning, the available traditional water storage and conveyance structures along with its supply and demand status for different sectors at Block level is necessary. Both spatial and non-spatial data including details and status on watershed and drainage network, canal network, irrigation facilities, catchments area wise available runoff, conserved runoff, present ground water extraction, water demand for domestic, agriculture and livestock, ground water utilization for domestic, agriculture and livestock are collected from authorized open sources and analysed at Block level.

3.5.1 SPATIAL DATA

Spatial data of geomorphology, lineament, terrain, slope drainage network, surface waterbodies, ground water potential, and watershed were collected to understand the site-specific problems and together with non-spatial data, take decisions to draft scientific key water actions. Available Bhuvan source thematic spatial maps/website view was referred to understand, interpret and analyze the spatial parameters of the Block.

3.5.1.1 Geomorphology: Geomorphology deals with the scientific study of "landforms and landscapes, including their description, type, and genesis". Landform is the end product resulting from the interactions of the natural surface genesis and the type of rock. The scope of geomorphology was further expended with landform maps, which are widely used in various fields of hydrology, pedology, geoscience, urban and regional planning etc. Broadly, Thiruppullani Block is engrossed with denudational, and costal origin landform units (Figure 3.1). Most of GPs engrossed with costal origin landform while few are with denudational landform. Costal landform is further classified based on the landform age and its characteristics including biodiversity existence such as older deltaic plain, young coastal plain and coral reef. GP-wise detailed view of the landforms with area in percentage is shown in the illustration below. This fundamental information of landforms by its units will act as critical input in identifying suitable sites for NRM activates under CWRM plan preparation.

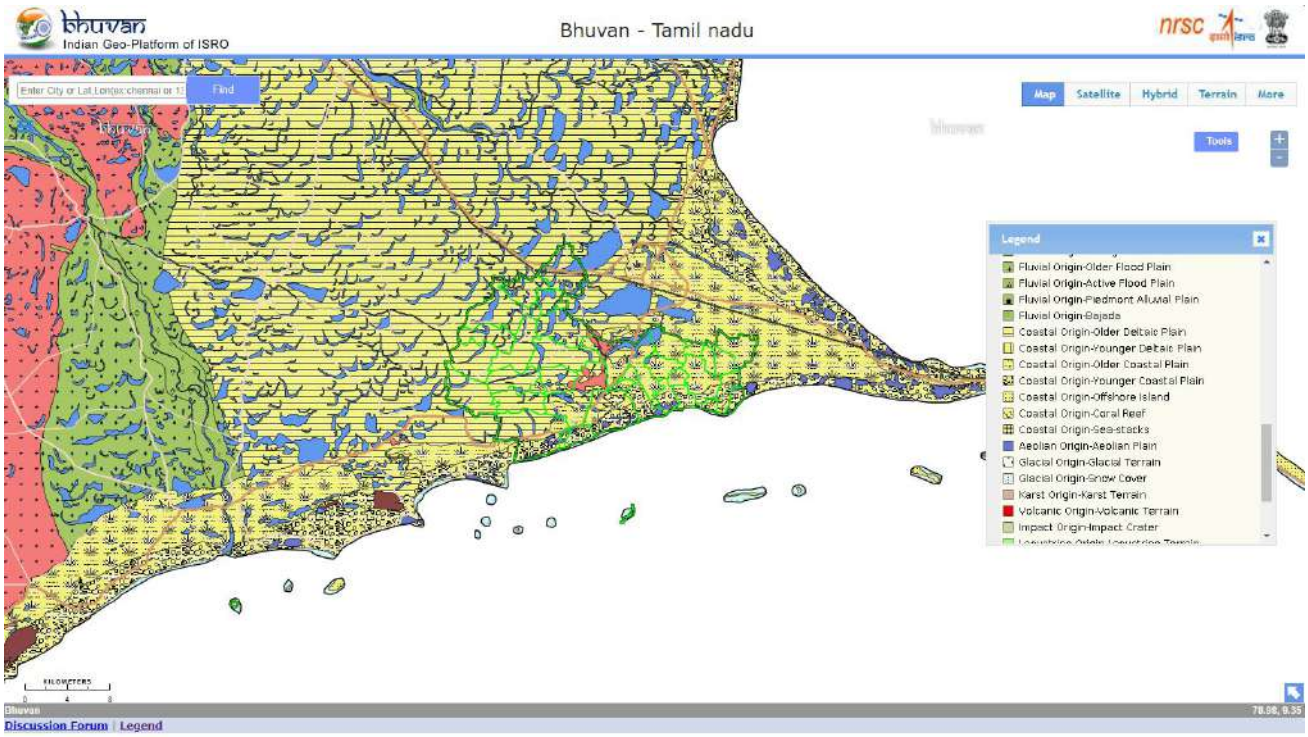
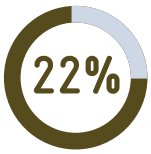
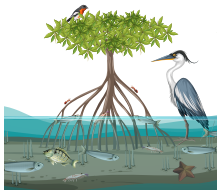
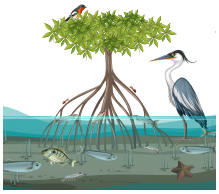


Figure 3.1. Geomorphology map

Landform unit	Area coverage in %	Gram Panchayat
Denudational Origin - Pediment - Pediplain Complete		
		Thadhanendhal - 30% Thillaiyendhal - 25% Kulapatham - 10%
Coastal Origin - Older Deltaic Plain		
		Alankulam, Ekkakudi, Kalari, Kompoothi, Landai, Mallal, Nallirukkai, Panaikkulam, Pannaiyadiyendhal, Thiru Uthirakosamangai, Vellamaruchakatti
Coastal Origin - Younger coastal Plain		
		Chinnadivalasai, Kuthakottai, Metholodai, Nain-amaraikaan, Pathiratharavai, Regunathapuram, Uthiravai, Kanjirangudi - 40 %, Thadhanendhal, Vannangundu - 20 %
Coastal Origin - Coral Reef		
		Thillaiyendhal - 45 %, Mayakulam - 35 %, Kalima-ngundu, Kanjirangudi - 30 %, Thinaikkulam - 25%, Keelakarai_TP, Periyapattinam - 20 %, Sethukka-rai - 15 %, Muthupettai - 10 %

3.5.1.2 Lineament: The lineament is also a lithological unit which reveals the hidden architecture of rock basement, representation of an underlying geological structure such as a fault, fracture (Figure 3.2). Lineament plays a significant role in identification of ground water and oil exploration sources. Lineament is represented with linear feature where two different landforms converge or diverges. This site allows water to percolate at a high rate. GP wise lineament type is illustrated in the table below. These observations are widely used to locate points of high-water flow especially in groundwater exploration.

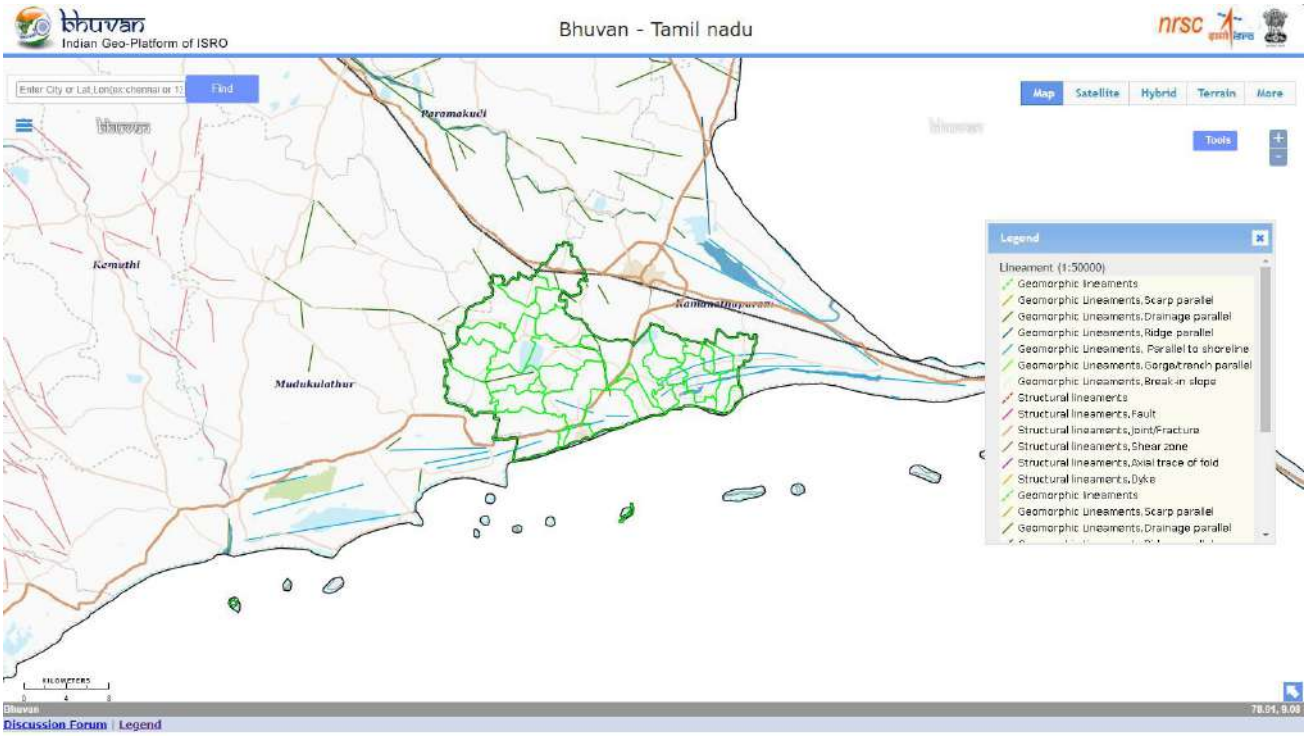


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Geomorphic lineaments, drainage Parallel	
	Kalari, Landai, Melamadai, Thadhanendhal, Thillaiyendhal
Geomorphic lineaments, parallel to shoreline	
	Kalimangundu, Kanjirankudi, Mayakulam, Nainamaraikaan, Periyapattinam, Regunathapuram, Thillaiyendhal, Thinaikkulam, Vannangundu

3.5.1.3 Terrain: The terrain map gives information related to elevation from above sea level. A terrain of same range is noticed in the Block area at the available scale map (Figure 3.3). This map will be useful in identification of better sites suitable for proposing water and soil conservation related activities.

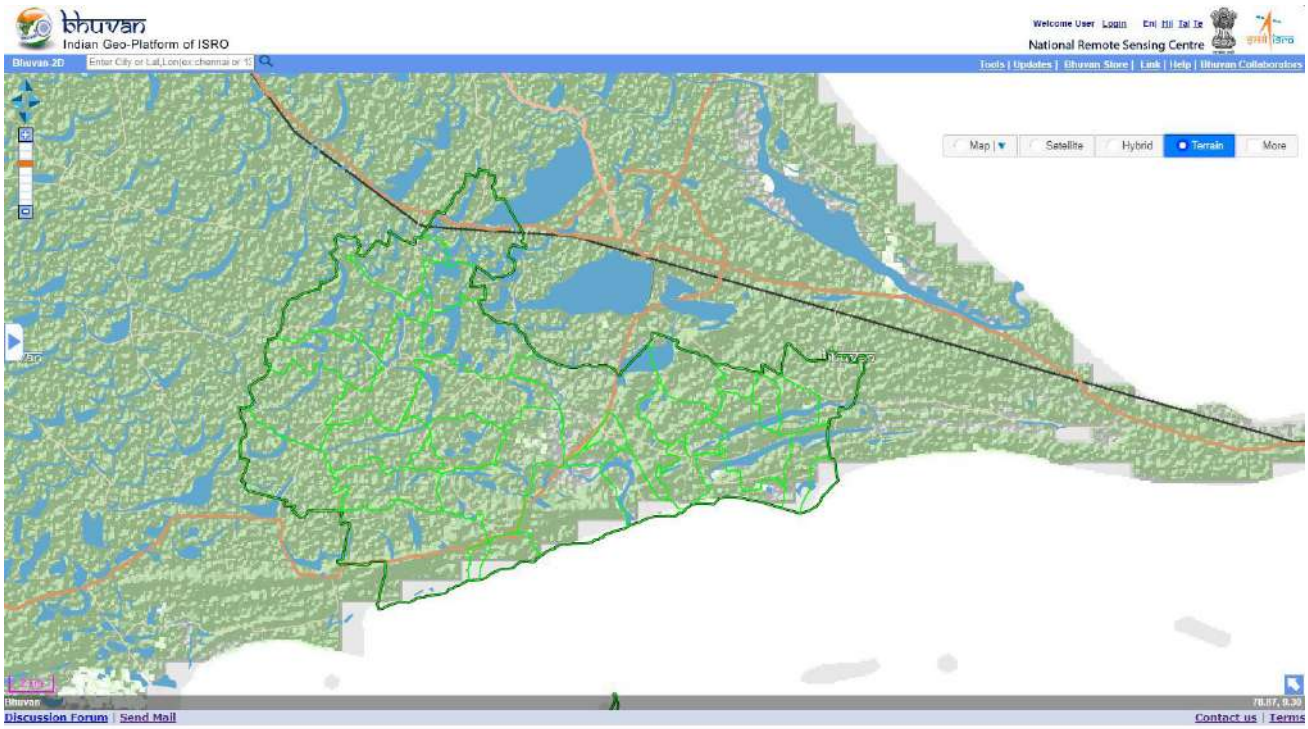


Figure 3.3. Terrain map

3.5.1.4 DEM map : The DEM is the important element in the representation of the terrain and only one which determines relief forms such as valleys and hills, and the steepness or gentleness of slopes geometrically. The map plays a vital role in delineation of watershed and its units, used in planning and identifying recharge structures, farm ponds and construction of grey water drain network etc., (Figure 3.4).

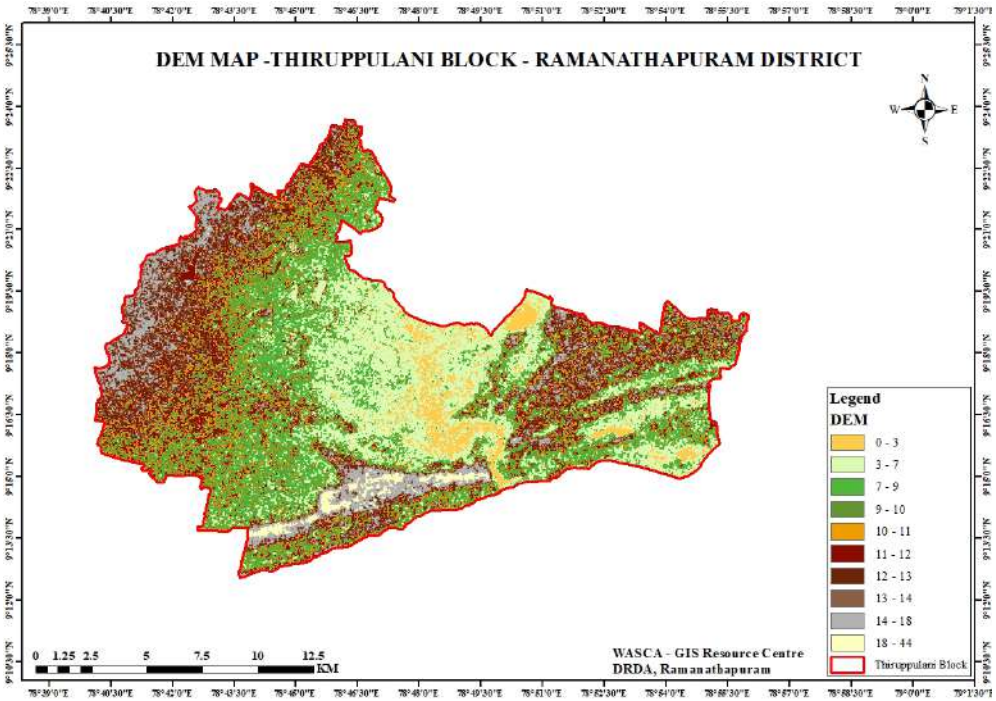


Figure 3.4. DEM

3.5.1.5 Slope: The average slope of a terrain feature is calculated from contour lines on a topology map or DEM. Slope is typically expressed in percentage, angle, or in ratio. Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. It is noticed that with respect to the landform units the slope varies in the Block (Figure 3.5). Very flat slope ranges from 0 to 1 % is noticed in the Block. Details of GP-wise slope area in percentage is shown in the illustration below. Slope information plays a significant role in identification of soil eroded sites, depth profiles, also used in analyzing / proposing soil conservation measures such as check dam, bunding land development, farm ponds etc.

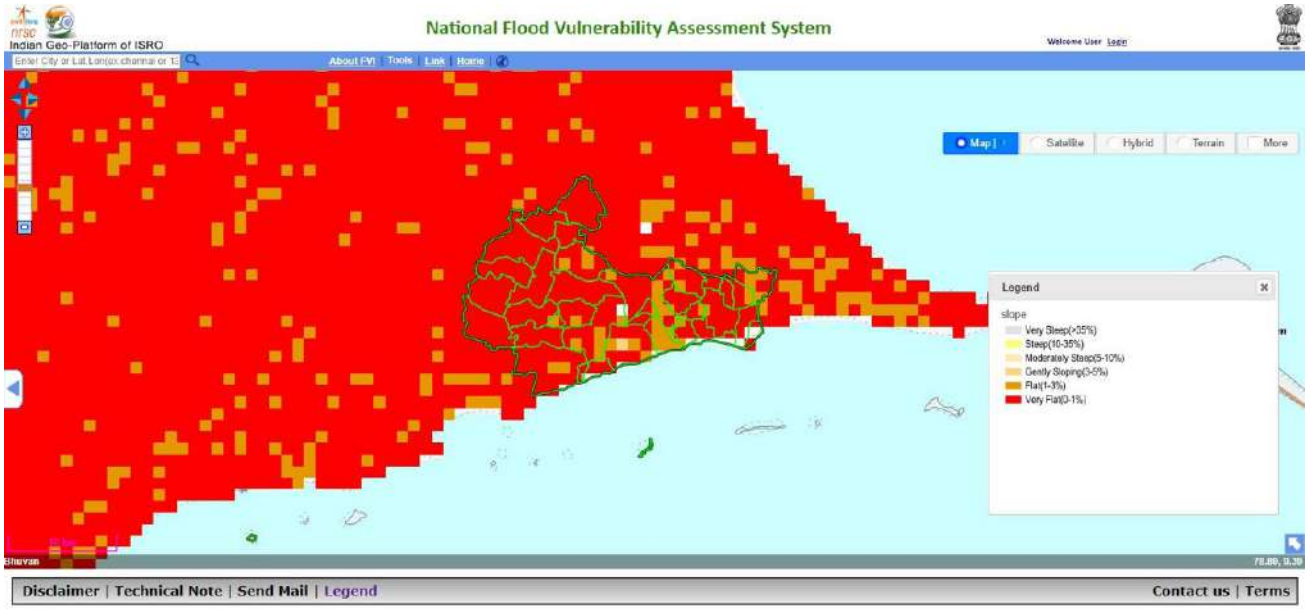


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Very flat (0-1%)	100%	Alankulam, Chinnandivalasai, Ekkakudi, Kalari, Kalimankundu, Kanjirangudi, Kompoothi, Koraikuttam, Kulapatham, Kuthakkottai, Landai, Mallal, Mayakulam, Melamadai, Methalodai, Muthupettai, Nainamaraikkan, Nallirukkai, Panaikkulam, Panaiyadiyenthal, Pathiratharavai, Periyapattinam, Regunathapuram, Sethukkarai, Thathanenthal, Thillaiyendal, Thinaikkulam, Thiru uthirakosamangai, Thiruppullani, Utharavai, Vannankundu, Velanoor, Vellamarichukkatti

3.5.1.6 Drainage Network: The drainage network pattern of a region is particularly dependent on the lithological characteristics, regional slope, structural control, climate condition etc. It is noticed that very less dense drainage network and a lower order stream is flowing towards South from North in the middle part of the Block (Figure 3.6). Drainage network is referred to while identifying suitable sites for soil and water conservation measurements such as dams, ponds, bunding, restoration of gullied region etc.

Figure 3.6. Drainage network and density

3.5.1.7 Watershed: Implementation of any water management measure requires a suitable hydrological unit. A properly delineated watershed forms a convenient hydrological unit for computation of water balance parameters and thus implementation of water management schemes. Also, in achieving a better sustainability in development mainly NRM at the grass root level, watersheds are recognized as viable and effective management units and adopted in most of the developmental programmes such as IWMP, MGNREGA etc. A watershed is the area/region of land where all of the water that falls in it and drains off goes into the common outlet. Thiruppullani Block watershed map is illustrated in Figure 3.7. Watershed is used for the interventions based on Ridge to Valley (R2V) concept and sequencing the plan accordingly. R2V approach intends to conserve each drop of rain water from ridge to a reasonable extent and it ensures the better surface water flow management also aids in strengthening the durability of land, soil and water conservation structures of the downstream.

Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water is one of the important natural resources in semi-arid region like Thiruppullani Block. The ground water perspectives map is the integration of lithology, geomorphology, geological structures, hydro geomorphic datasets, which provides the required information related to ground water exploration and the probable ground water prospects. This map will help in identification of tentative locations for construction of recharge structures.

In the Block area, ground water is available from 30 m itself also noticed that the yield is more around 30 m deep well with 100-200 LPM. The GPs wise yield of GW is shown in the illustration below. GPs which are situated in eastern side and along the coast shore witness the GW in less than 30 m with yield of 50 to 100 LPM, while West region of Block area witnessed the GW between 30 – 80 m with yield of 30 – 50 LPM (Figure 3.8). The GPs wise detailed of Ground Water (GW) prosperity shown in below illustration. This specific information will play a crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

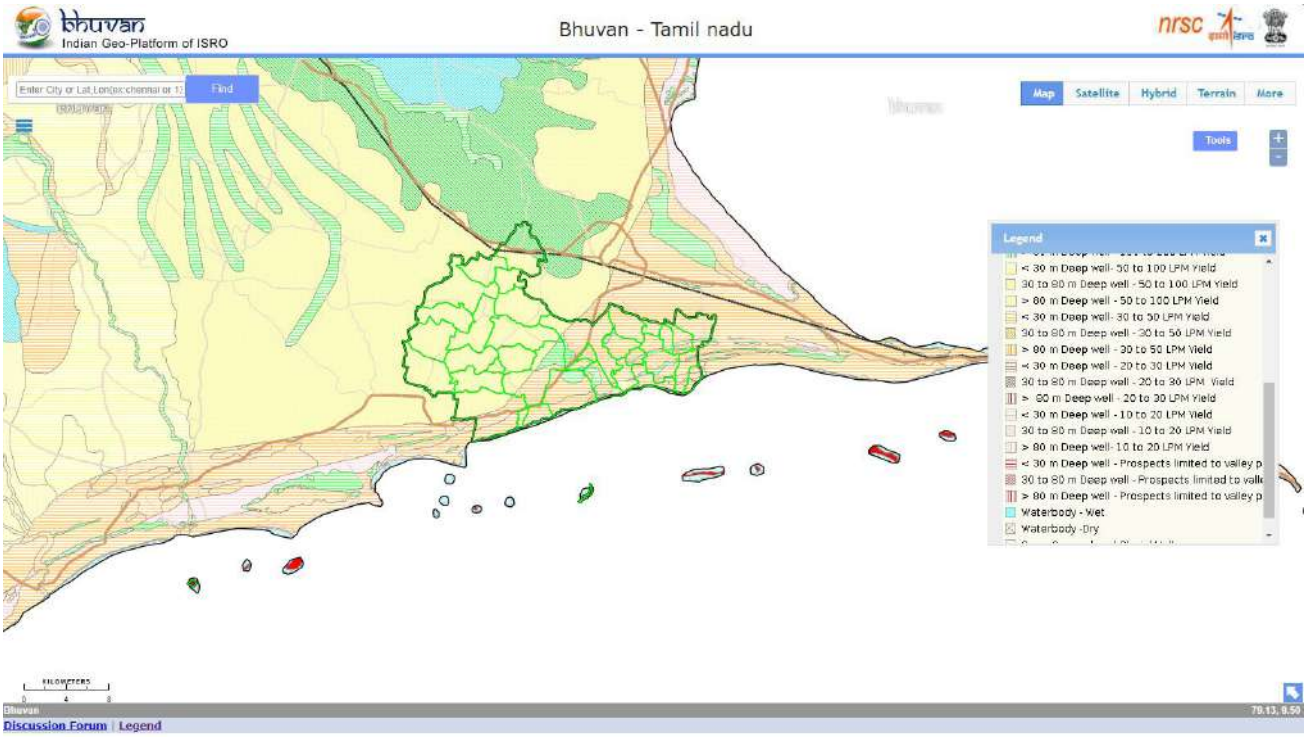


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat

30 to 80m Deep well - 50 to 100 LPM Yield

79%

Alankulam, Ekkakudi, Kalari, Kompoothi, Kulapatham, , Mallal, Nallirukkai, Panaikkulam, Pannaiyadiyendhal, Thiru Uthirakosamangai, Velanoor, Vellamaruchakatti - 100%, Landai, Mayakulam - 5%, Thillaiyendhal - 30%, Thadhanendhal - 20%

<30 m Deep well - 30 to 50 LPM Yield

71%

Chinnadivalasai, Keelakarai_TP, Muthupettai, Periyapattinam - 100%, Regunathapuram, Uthiravai - 95%, Kuthakkottai, Nainamaraikaan - 90%, Kanjirangudi, Pathiratharavai, Vannangundu - 80%, Kalimangundu, Thadhanendhal - 7%, Thinaikkulam - 70%, Koraikootam - 60%, Mayakulam - 50%, Sethukkarai, Thillaiyendhal - 40%

< 30 m Deep well - 100 -200 LPM Yield

17%

Koraikottam, Sethukkarai, Thillaiyendhal - 30%, Nainamaraikaan, Thadhanendhal - 20%, Vannangundu - 15%, Periyapattinam - 10%, Kuthakottai, Pathiratharavai, Uthiravai - 5%

30 m Deep well - 100 to 200 LPM yield

50%

Landai

3.5.1.9 Analysis of Physicochemical parameters: Physicochemical parameters were assessed to understand their influences on nature of water through Water Quality Index (WQI), Seawater Mixture Index (SMI) and Salinity. To understand WQI and SMI, 28 water samples were collected across Block area, out of which 18 samples were of open well water and remaining were from ground water (Figure 3.9).

Figure 3.9. Location of water samples

WATER QUALITY INDEX

The WQI is defined as a measure of rating that provides the composite influence of individual water quality parameter to overall water quality. WHO (2004) recommended ten parameters such as pH, TDS, HCO_3, Cl, SO_4, NO_3, Ca, Mg, Na and K to determine the water quality. The results showed that the average content of ions was as follows: Cl > TH > Na > TA > Ca > HCO_3 > Mg > CO_3 > $S0_4$ > NO_3 > K. The predominant hydro-chemical facies are Chloride (C) and total hardness (TH) while Potassium (K) is very less. The excellent water quality / suitable water for domestic purpose is found in seven sports (blue colour in Figure 3.10) over Block area while very poor quality water/ unsuitable water for domestic purpose with index value >300 found in three spots. Buffer area of very poor sites falls under poor quality water of index zone ranging 200 to 300 and same range spots were also found in the East region. However most of the area falls under good water quality zone of index value range 50-100 (Figure 3.10). These zones act as inputs in identifying suitable sites to propose appropriate treatment measures. GP wise water quality during pre and post monsoons are attached in Annexure 3.8 and 3.9.

Physicochemical parameters	Cl	TH	Na	TA	Ca	HCO3	Mg	CO_3	$S0_4$	NO_3	K
Average in mg/l	1512.55	776.41	498.99	357.21	346.39	243.65	201.35	87.82	34.73	21.97	12.57

(TH = Total hardness, TA = Titratable acidity, Ca =calcium, Na= Sodium, Cl= Chloride, HCO3=Bicarbonate, Mg= Magnesium, SO4= Sulphate, NO3= Nitrate, K= Potassium, CO3= Carbonate)

EXCELLENT QUALITY	<50
GOOD QUALITY	50- 100
MEDIUM QUALITY	100- 200
POOR QUALITY	200-300
VERY POOR QUALITY	>300

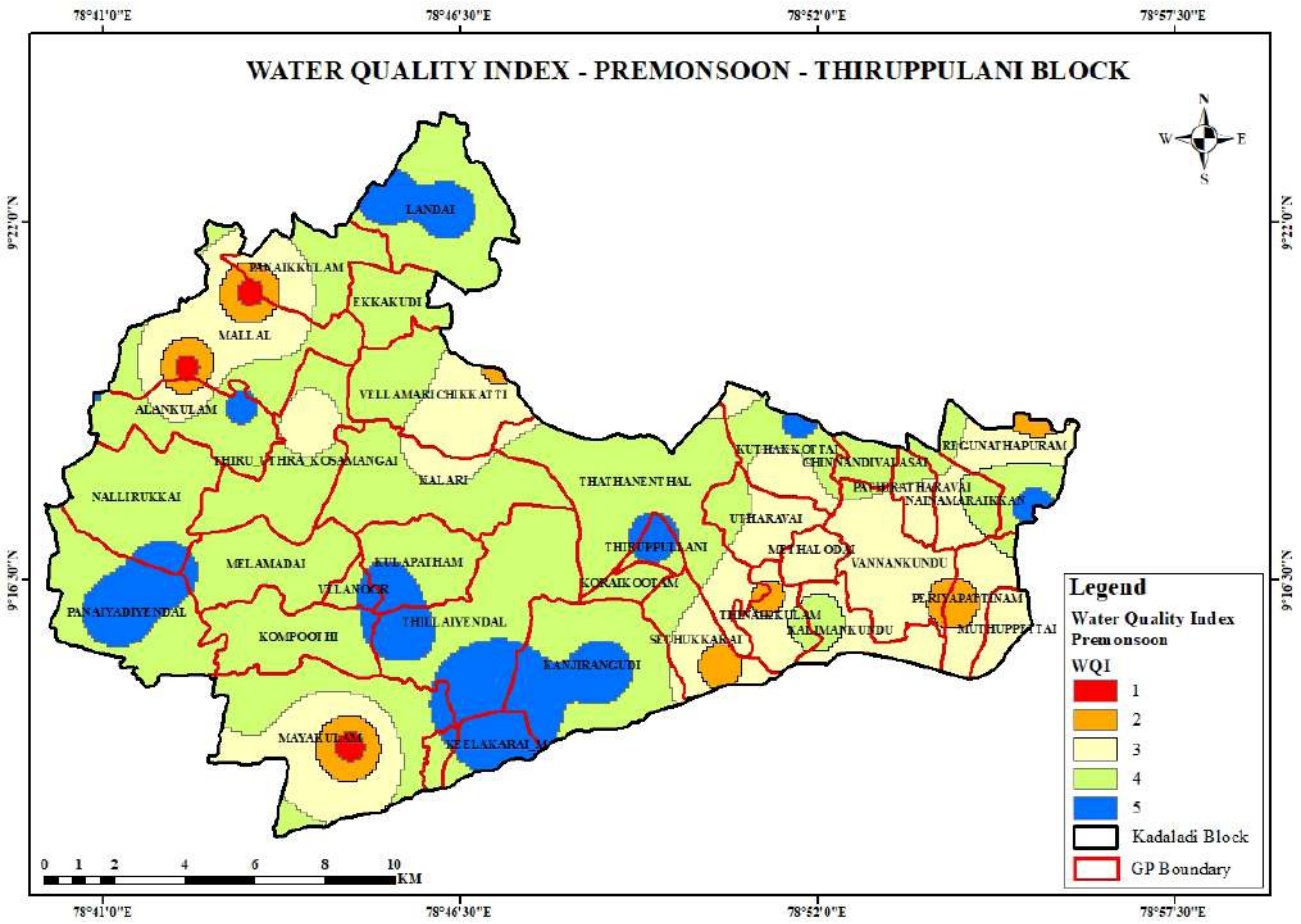


Figure 3.10. Water Quality Index

Seawater mixing index:

SWI parameter is calculated based on mixing of major ionic constituents (Na, Cl, Mg, and SO_4) of sea water to ground water during pre-monsoon season. The results showed that the average content of ions was as follows: Na > Ca > Mg > $S0_4$. The predominant hydro-chemical facies are Sodium followed by calcium while sulphate is less. Geographically three spots were found with high SMI while 6 zones with less sea water mixed. However, most of the Block area falls under the index value range 2- 3 which is moderate (Figure 3.11).

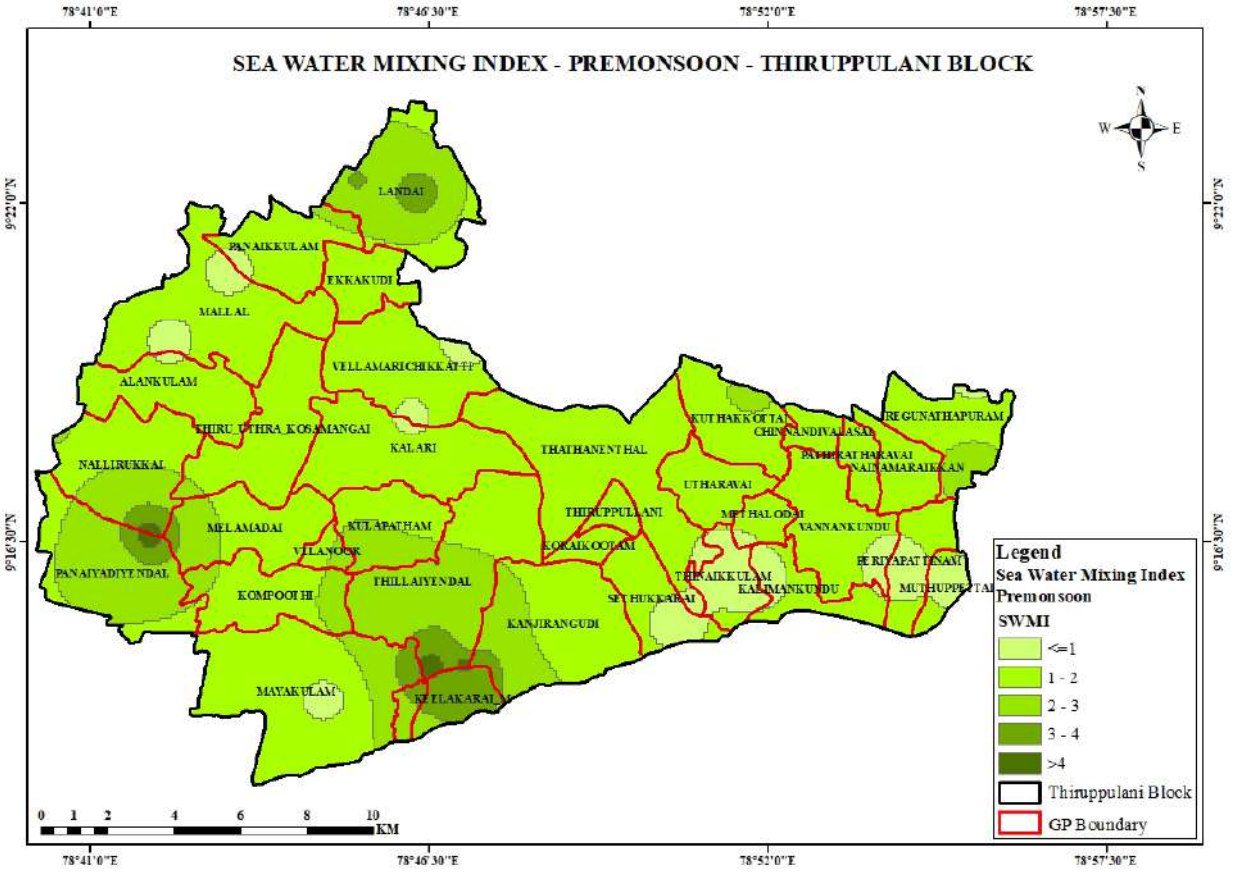


Figure 3.11. Seawater mixing Index

Salinity:

Seawater mix and salinity in the water are directly proportional, higher the sea water mix higher the salinity in the water (Figure 3.12). This Block is vulnerable to the dynamics of costal related hazards, with high sea water mix and high salinity in water.

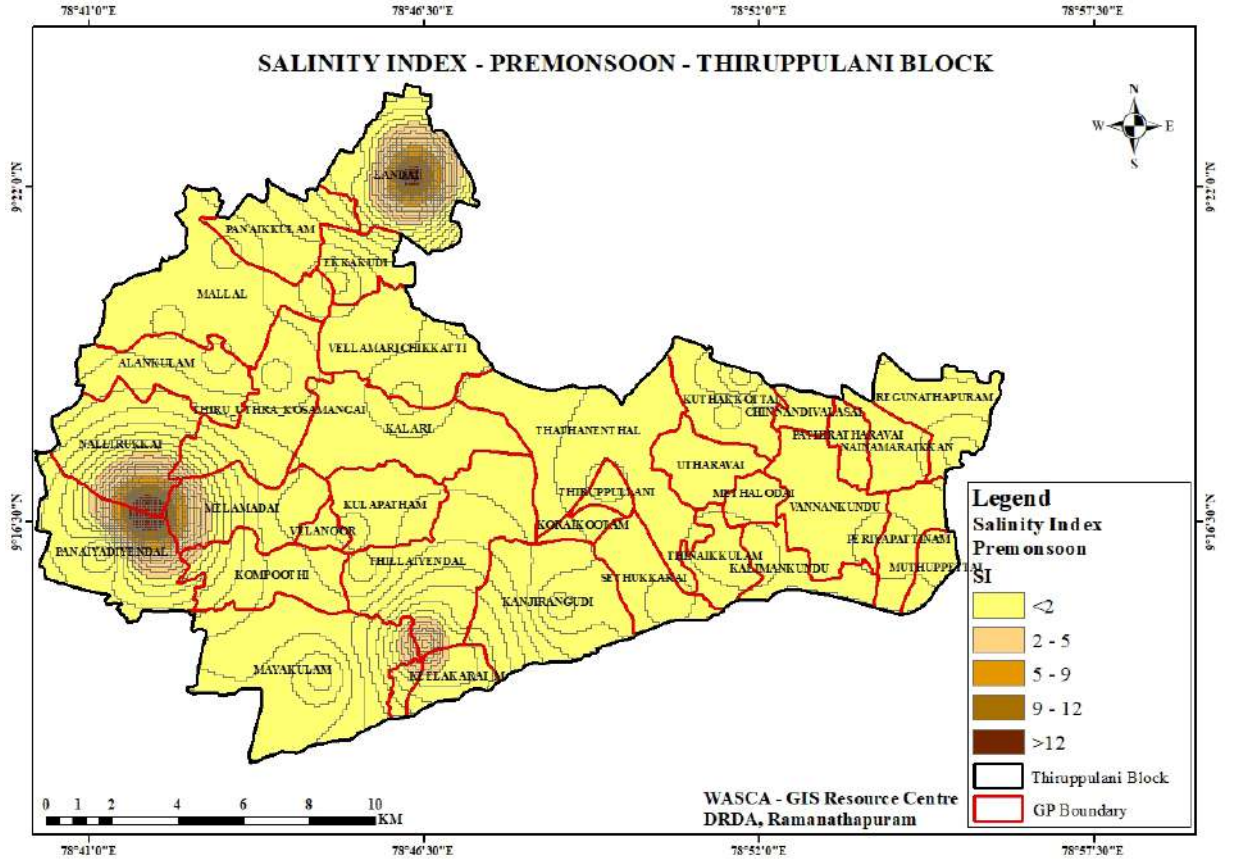


Figure 3.12.Salinity index

3.5.2 NON SPATIAL DATA

Water resource based non-spatial secondary data related to irrigation facilities such as canal, traditional waterbodies, water quality, demand and supply were collected from Govt. sources (Table 6). GP wise current water resources status and its supply and demand side are shown in Annexure 3.7.

TABLE 6. CWRM PARAMETER-BASED WATER RESOURCES STATUS IN THE BLOCK

S No	Key CWRM Parameter	Total/average
	Canal Network	
1	Length of Main Canal (m)	57,300
2	Length of Minor Canal (m)	15,200
3	Length of Distributaries (m)	2,000
4	Water Courses (Field Channels) (m)	89,500
	Traditional Waterbodies	
5	Number of Tanks (PWD & Union) (No.)	62
6	Number of Ooranis (No.)	361
	Irrigation Facilities (ha)	
7	Tank Irrigation	4,624
8	Canal Irrigation	35
9	Open & Tube Well Irrigation	1,286
	Catchment Area wise Available Runoff (ha.m)	
10	Good Catchment Area	1,752
11	Average Catchment Area	1,039
12	Bad Catchment Area	1,640
	Watershed and Drainage Networks	
13	Length of Natural Drainage Lines (m)	8,02,148
14	Number of Natural Drainage Lines (No.)	72
15	Number of Micro-watersheds (No.)	181
	Water Demand	
16	For Humans (ha.m)	379
17	For Livestock (ha.m)	40
18	For Agriculture (ha.m)	12,649
19	GW utilization for Drinking (%)	94
20	GW utilization for Livestock (%)	63
21	GW utilization for Agriculture. (%)	14
22	SW utilization for Drinking (%)	6
23	SW utilization for Livestock (%)	37
24	SW Utilization for Agriculture (%)	86

3.5.2.1 Existing Water Structures

The Block has structured traditional water storage units such as tanks and ooranis: waterbodies which are the life line of local communities for their lives and livelihoods. It is noticed that the ooranis are more (361) than tanks (62) (Figure 3.13).

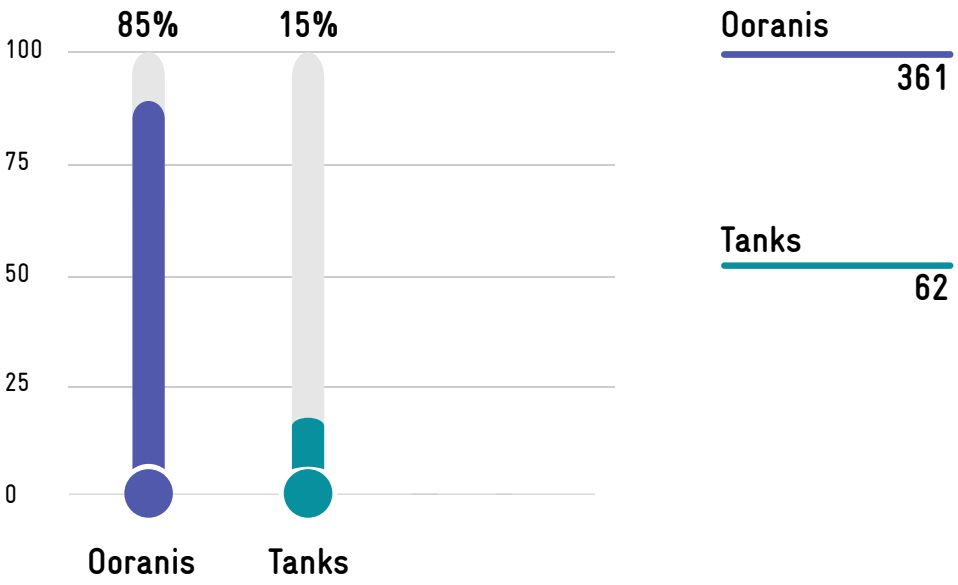


Figure 3.13. Traditional waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 5,944 ha, of which 77.8 % (4,624 ha) is irrigated through tanks, followed by 21.26 % (1,286 ha) through open/tube well and the remaining 0.58 % (35 ha) area is through canals-based irrigation (Figure 3.14).

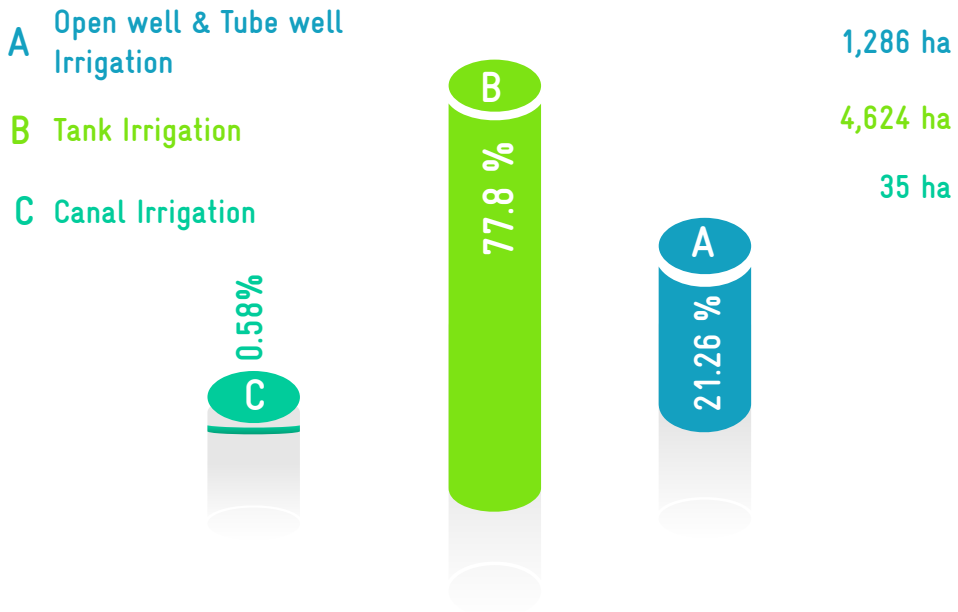


Figure 3.14. Irrigation source

3.5.2.3 Available Run off

The total available runoff in the catchment area is 4,431 ha.m out of which 39.54 % is good catchment area followed by 37 % is bad catchment area and the remaining 23.45 % is average catchment area. As the area has worse catchment area, the runoff generated is more (Figure 3.15).

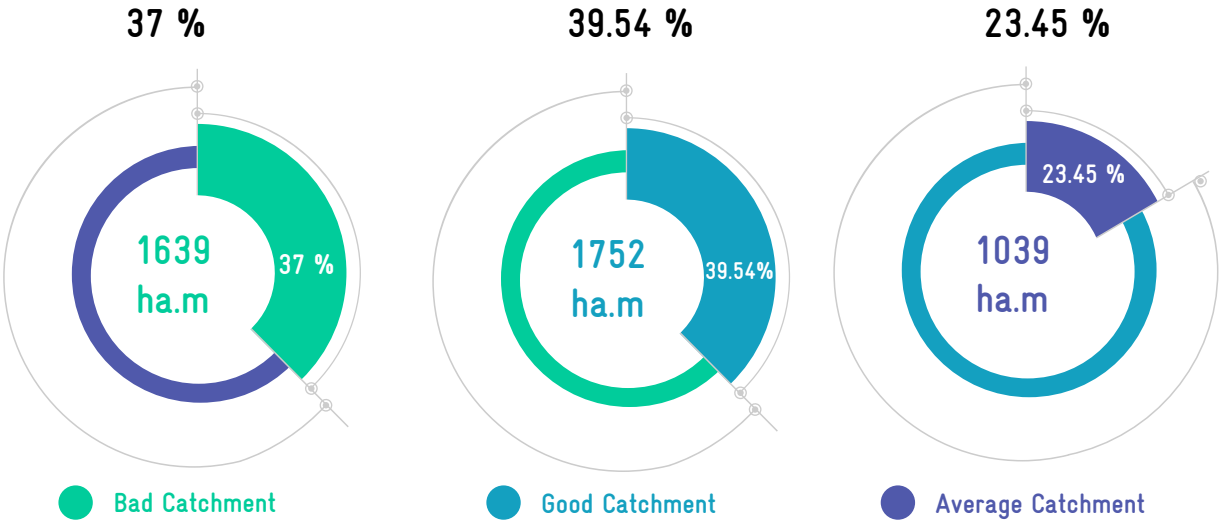
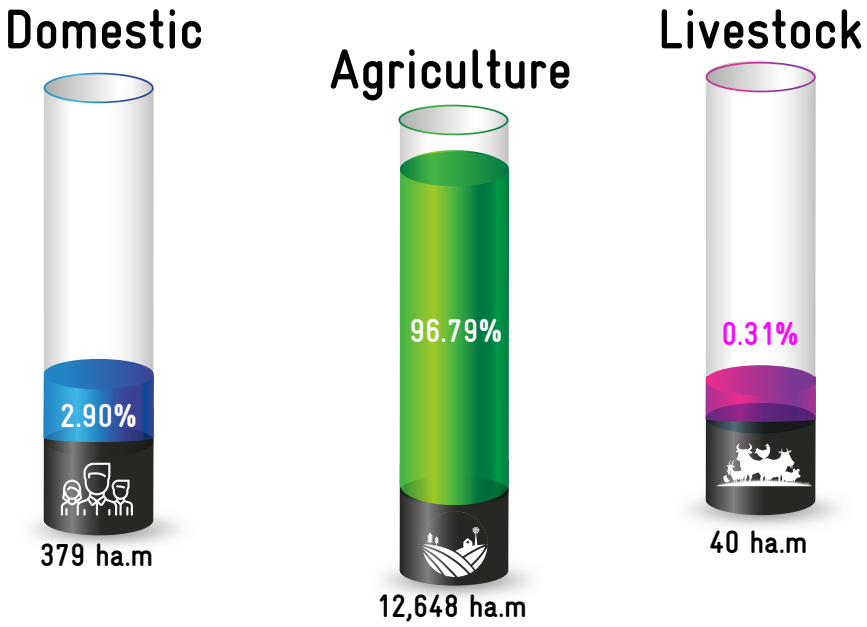


Figure 3.15. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 13,068 ha.m. The highest demand is from the agriculture sector of 12,648 ha.m (97 %) followed by domestic use demand of 379 ha.m (3 %) and rest is from livestock.



Out of the total water demand, 94 % for domestic purpose usage is met through ground water while the remaining 6 % from surface water resources. For agriculture, 86% is utilized from surface water and 14 % is from ground water. While 63 % for livestock requirement is met by ground water (Figure 3.16).

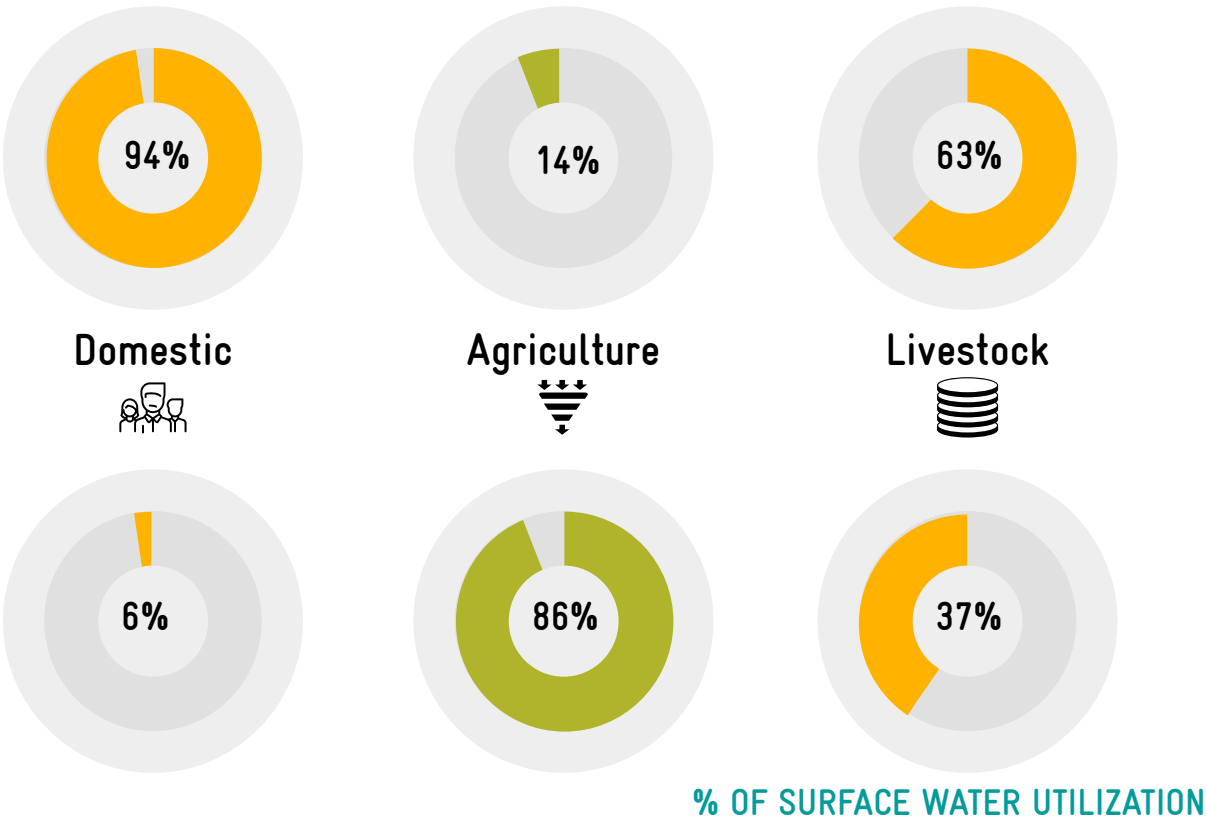


Figure 3.16. Sectoral-wise water utilization

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

Agriculture is the primary livelihood of the households in Thiruppullani Block followed by livestock resources. Considering water and monsoon patterns, the key agriculture factors such as soil, land, crop and livestock related parameters are employed in CWRM planning.

3.6.1 SPATIAL DATA

Bhuvan based spatial data for LULC, waste land, salt affected land, soil erosion and soil texture were taken into consideration to understand Thiruppullani Block's problems in order to draft scientific key water actions.

3.6.1.2 Soil texture: The soil consistency of particle size is distinguished through soil texture types, especially determined by the amount of sand, silt or clay. The Block has diverse soil types and predominant in vertisol and alfisol. With reference to soil texture, the proportion of fine type is dominant across the Block (Figure 3.17). Soil texture helps in determining the properties of the soil such as water holding capacity, permeability, soil workability and also the ability of plants to grow. This data will help in proposing relevant conservation measures for natural resources.

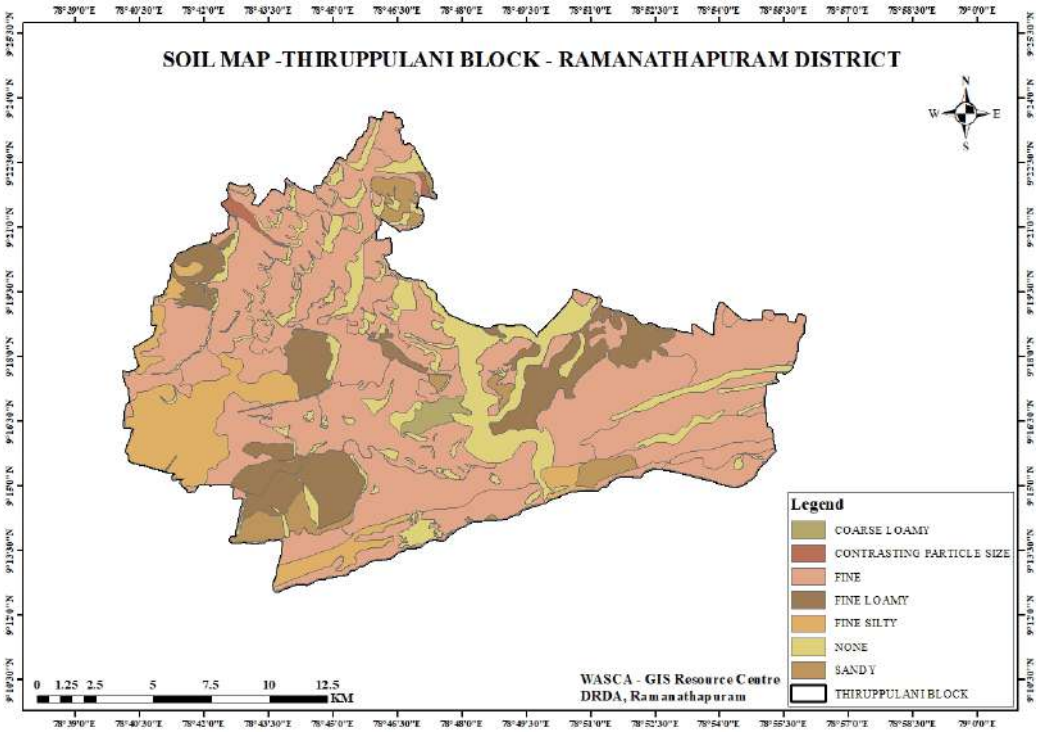


Figure 3.17. Soil texture

3.6.1.4 Soil erosion: Soil erosion is a natural process of displacement of upper layer of soil caused by dynamic erosion agents i.e. water, air, plants and humans. Sheet erosion type soil erosion is found in the southern-western region of the Block (Figure 3.18) and the illustration below gives area wise soil erosion details of the GPs. Soil eroded sites will help in preparing plans, to suggest soil conservation and watershed management activities.

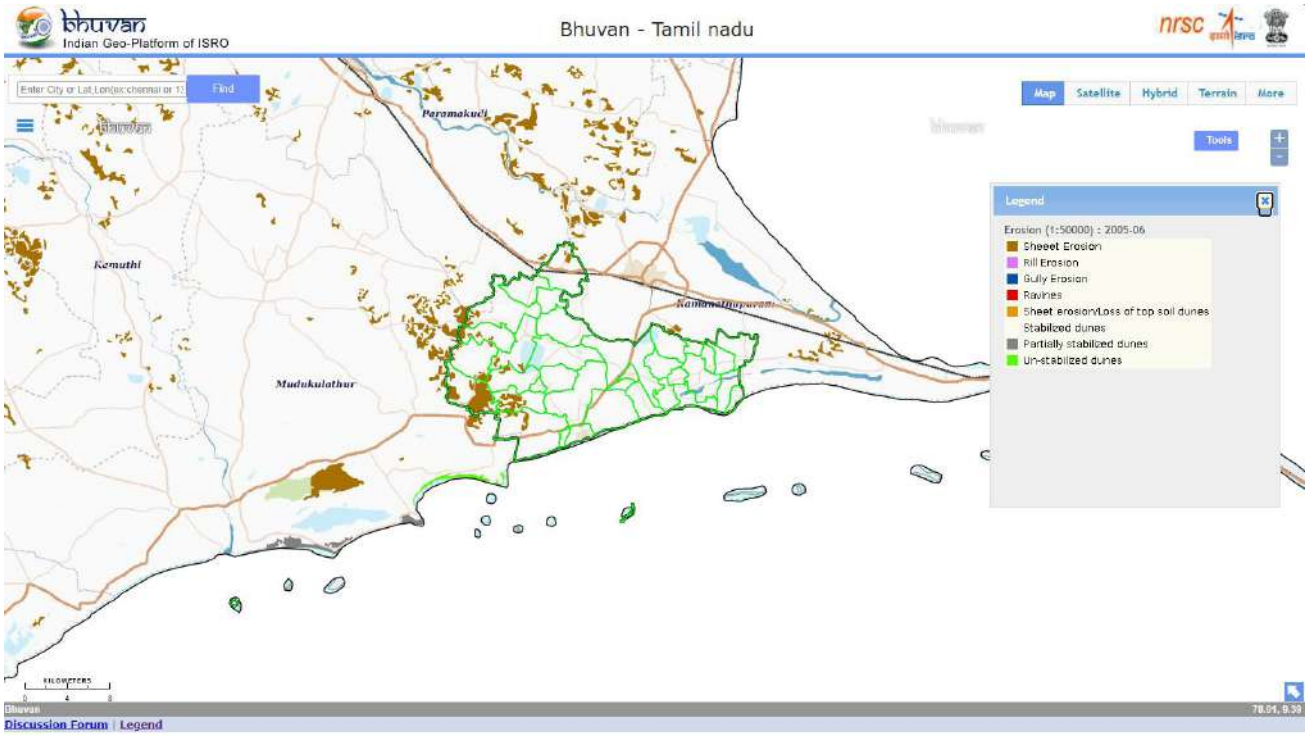
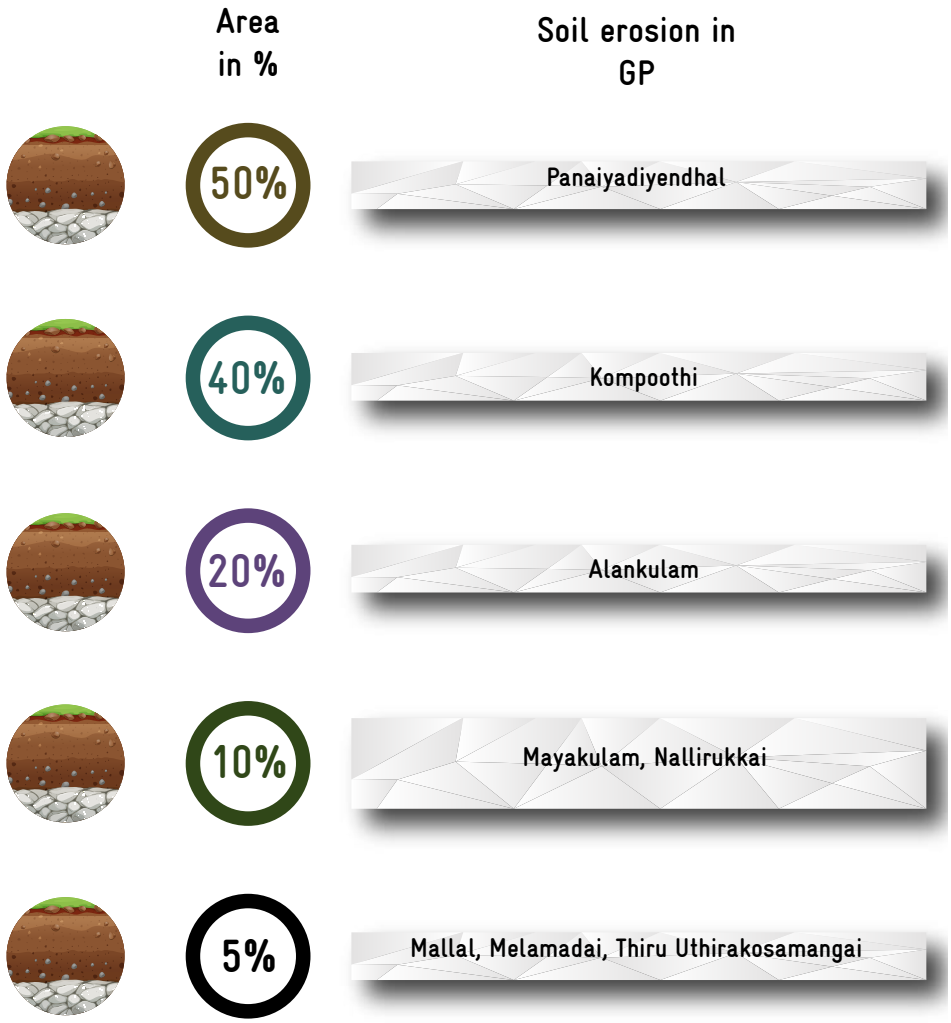


Figure 3.18. Soil erosion map



3.6.1.3 Land Use and Land Cover: LULC are two separate terminologies which are often used interchangeably. In general, land cover is defined as 'the observed biophysical cover on the Earth's surface'. It includes vegetation and man-made features as well as bare rock, bare soil, and inland water surfaces; while land use refers to 'the way in which land has been used by humans and their habitat, usually with the accent on the functional role of land for economic activities'. LULC has become an increasingly important factor playing a major role in making environment-development policies. Thiruppullani Block is majorly covered by the agricultural crop, fallow land followed by forest area and barren land (Figure 3.19). The GP wise LULC is tabulated in Table 7. LULC map helps the decision makers and planners to focus on the fallow land development activities.

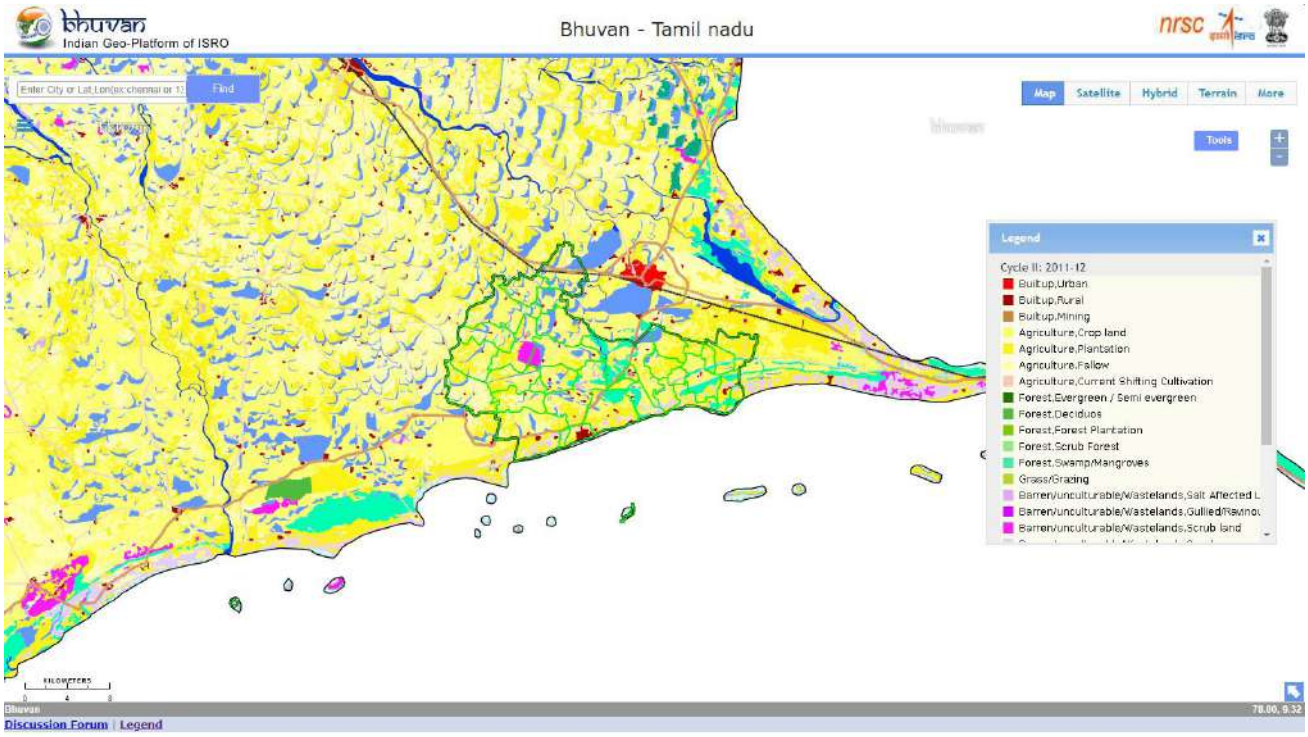


Figure 3.19. Land use land cover map

TABLE 7. DETAILS OF LULC AT GP LEVEL

Land Use	Area coverage in %	Gram Panchayat
Barren Lands	37%	Thiru Uthirakosamangai - 40%, Kalari - 33%
Agriculture, Fallow lands	39%	Panaiyadiyendhal - 80%, Landai, Thinaikkulam, Veranoor - 70%, Ekkakudi, Methelodai, Panaikkulam - 60%, Alankulam, Vellamarichikkatti - 50%, Kalari, Kompoothi - 45%, Mallal, Nainamaraikkan, Nallirukkai - 40%, Kanjirankudi, Mayakulam, Melamadai, Pathiratharavai, Uthiravai - 30%, Regunathapuram - 25%, Kuthakottai, Thadhanendhal, Thiru Uthirakosamangai - 20%, Kulapatham, Sethukkarai, Thillaiyendhal - 10%, Keelakarai_TP - 5%
Agriculture crop lands and Plantation	25%	Thadhanendhal - 50%, Vannangundu - 45%, Sethukkarai - 40%, Muthupettai - 30%, Periyapattinam - 25%, Kalimangundu, Kanjirangudi, Nainamaraikan - 20%, Pathiratharavai, Thillaiyendhal - 15%, Regunathapuram - 10%, Kulapatham - 5%

3.6.1.4 Waste land: A Parcel of land that is not suitable for any agriculture activity and mostly covered with dense or open scrub is called as wasteland. The extent of wasteland will act as a direct input for preparation of plans for land development activities or greenery. Salt affected and sandy area types of wastelands is noticed in Thiruppullani Block (Figure 3.20). GP wise details is shown in the illustration below. During planning for the GPs, plantation measures have been taken up in the identified portions to convert the wasteland into productive land.

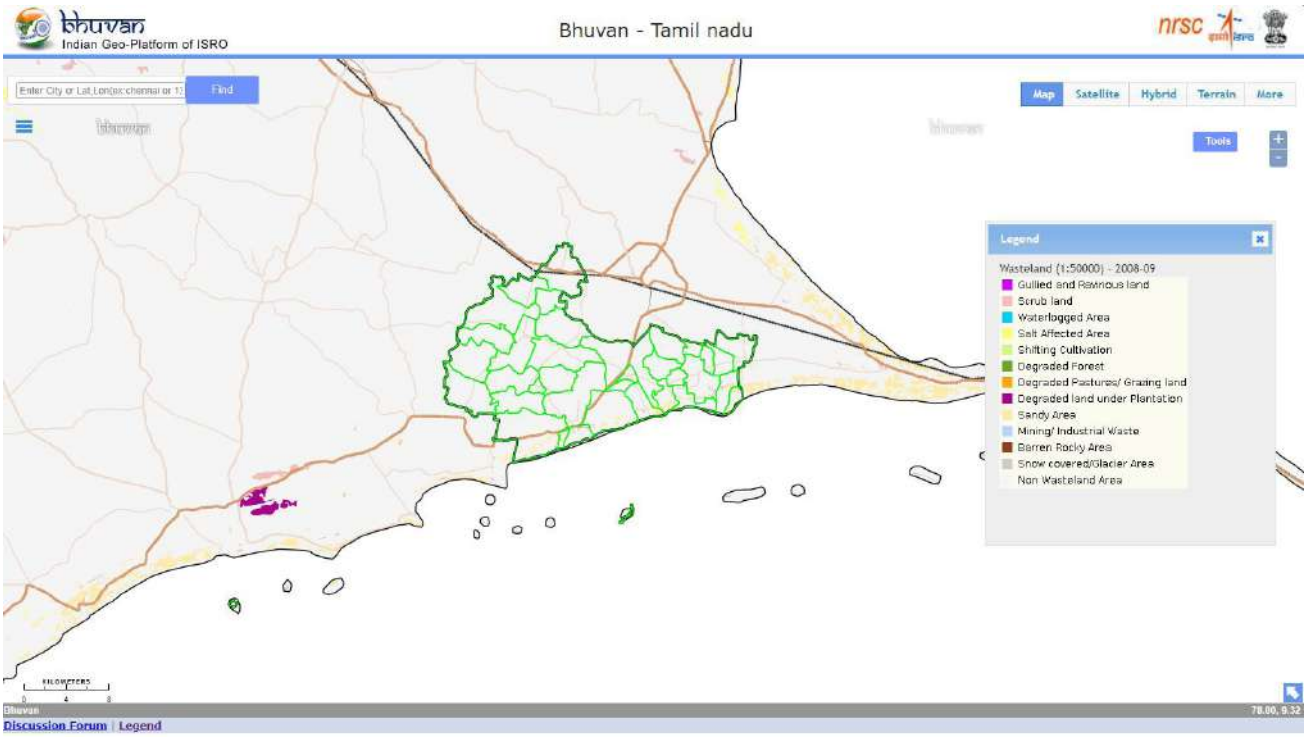
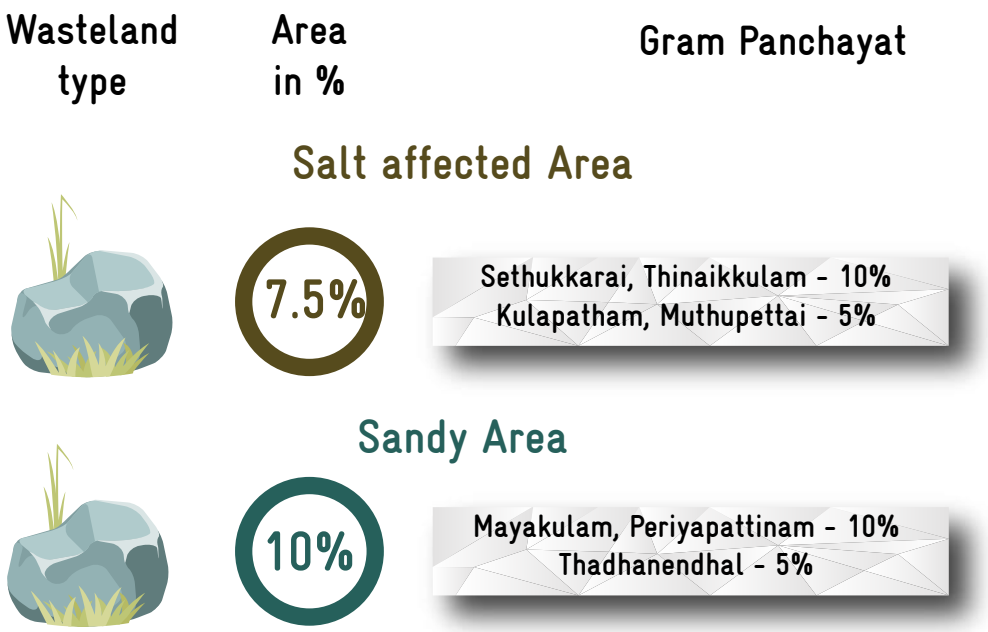


Figure 3.20. Wasteland map



3.6.1.5 Salt affected area: Due to the Block's proximity to costal region, one fourth of the Block area is sodic and same was also found in the results of salinity analysis of water samples. 90 % of areas of Thiruppulani_TP and Velanoor GPs is salt affected which is the highest, while Kalari GP area is the least affected with 5% area affected by salinity. (Figure 3.21). GP-wise details of salt affected area is shown in the illustration below. These parcels will act as a direct input in the planning process to propose soil conservation measures, mainly activities to reduce salinization and suggestions for alternative cropping.

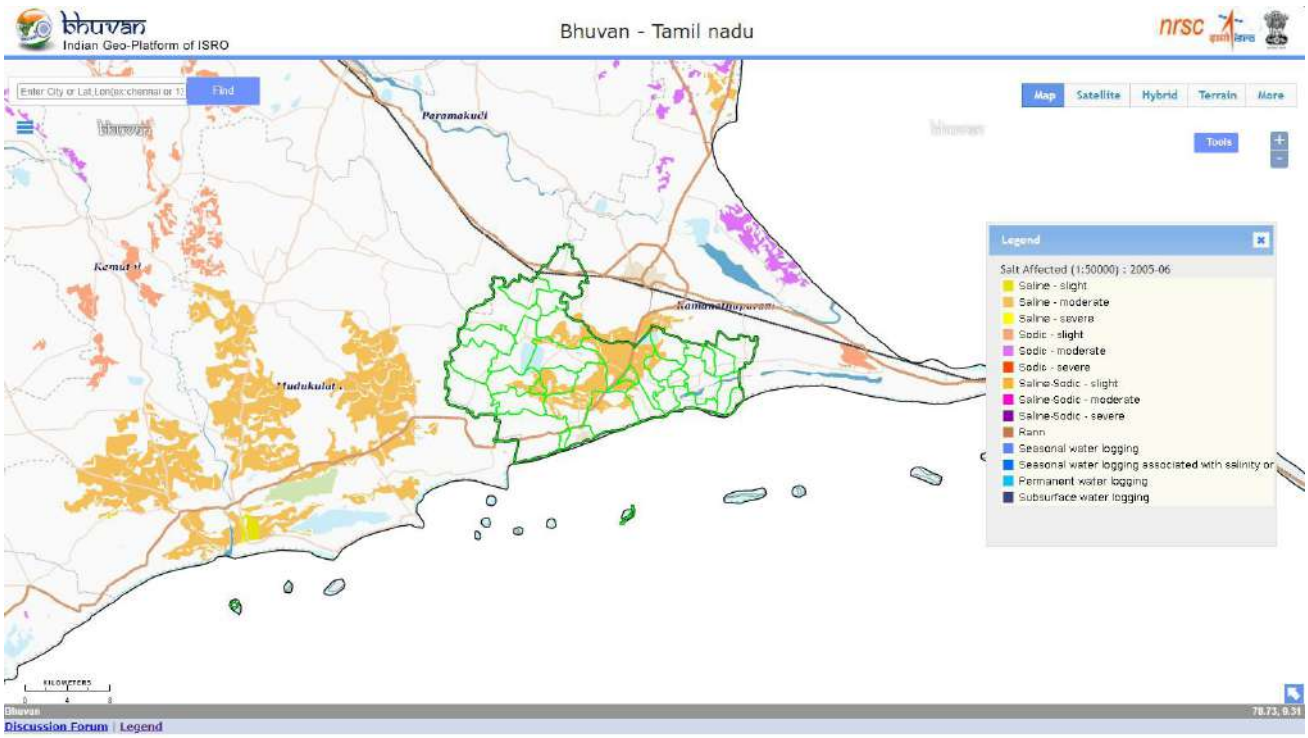
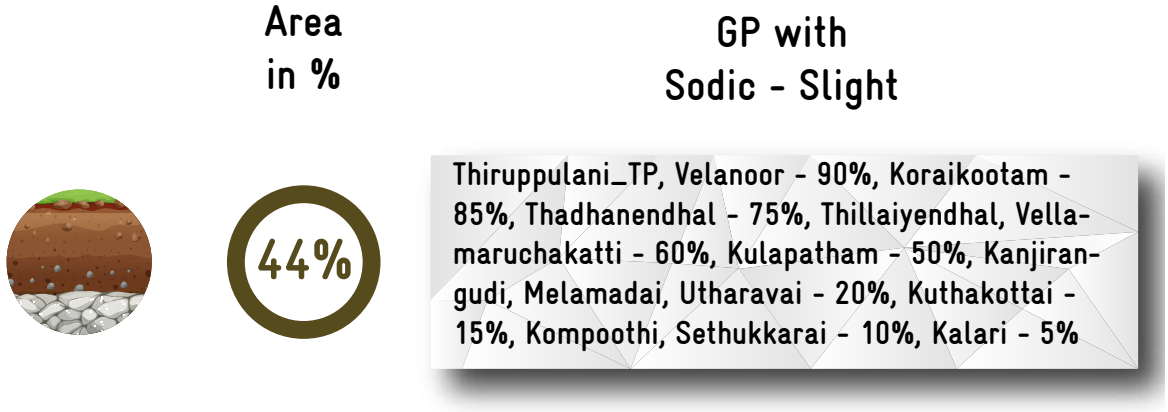


Figure 3.21. Salt affected area



3.6.2 NON SPATIAL DATA

Agriculture based non-spatial secondary data related to land resources, catchment, crop type, soil micro-macro nutrient, moisture, ET and livestock data were collected from govt. sources (Table 8.) The key CWRM parameters of agriculture area for all GPs are tabulated in Annexure 3.10.

TABLE 8. CWRM PARAMETER-BASED AGRICULTURE RESOURCES STATUS IN THE BLOCK

Key CWRM Parameter	Total/average
Land Resources (ha)	
Non-Agricultural Uses	7,897
Land Under Miscellaneous Tree Crops etc.	5,697
Cultivable Waste Land	401
Fallows Land other than Current Fallows	308
Current Fallow land	1,456
Unirrigated Land	6,749
Area Irrigated by Source	5,921
Land under Catchment Area (ha)	
Good Catchment	7,897
Average Catchment	6,098
Bad Catchment	14,434
Crop details	
Irrigated Area (ha)	5,929
Rainfed area (ha)	7,207
Paddy Cultivation (ha)	8,261
Crop Water Requirement - Irrigated condition (ha.m)	5,982
Crop Water Requirement - Rainfed condition (ha.m)	6,520
Soil Resources: Status of Available Nitrogen (%)	
Very Low	52
Low	43
Medium	4
Status of Organic Carbon (%)	
Very Low	22
Low	26
Medium	21
High	14
Very High	17
Status of Soil Micro Nutrients (%)	
Sufficient	57
Deficient	43
Status of Physical condition of the soil (%)	
Moderately Acidic	17
Slightly Acidic	8
Moderately Alkaline	74
Soil Texture in %	
% of Fine Soil	83
Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	17

Estimated Soil Moisture (ha.m)	3,490
ET Losses (ha.m)	9,588
Means of water extraction (%)	
Gravity	72
Lifting	28
Irrigation methods (%)	
Wild Flooding	83
Control Flooding	17
Livestock (No.)	
Cattle Population	6,419
Sheep Population	23,900
Goat Population	19,094
Poultry	20,883

3.6.2.1 Land utilization

The standard land use classification helps to understand the distribution and the extent of different land use categories. As the runoff and water harvesting actions are linked to the land use systems, its distribution across the geographical boundary of the Block is necessary to take decisions. Of the total land area of 28,429 ha, the highest of 27.78 % land is under miscellaneous tree crops, followed by 23.74 % unirrigated land, while less than six percent of land is cultivable wasteland, current fallow and fallow land other than current fallows (Figure 3.22).

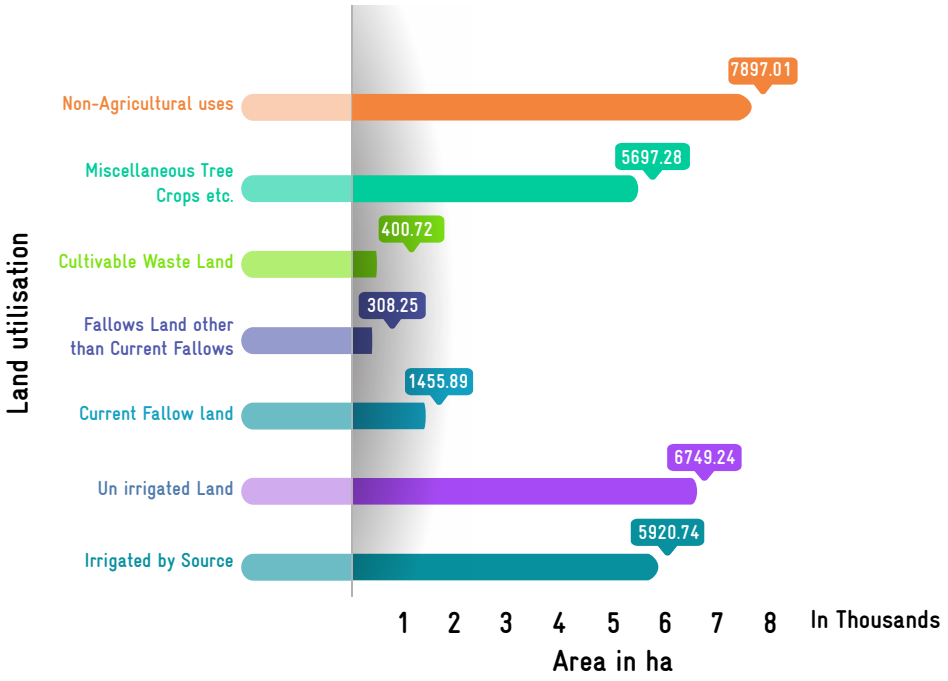


Figure 3.22. Land utilization

3.6.2.2 Catchment Area

The land use types in each of the GPs are categorized into three different types of runoffs; good, average and bad catchment area. Out of total catchment area of 28,429 ha, of the Block, the highest of about 50.77 % from bad catchment area followed by 27.78 % from good catchment area and remaining is under average catchment area. This analysis helps to focus on prioritizing the works in the land use systems under the good and bad catchment areas (Figure 3.23). It is noticed that the good and average catchment area are with similar extension, with effective and better plans of treatment measures, there is a high possibility of converting the average catchment area to good catchment area.

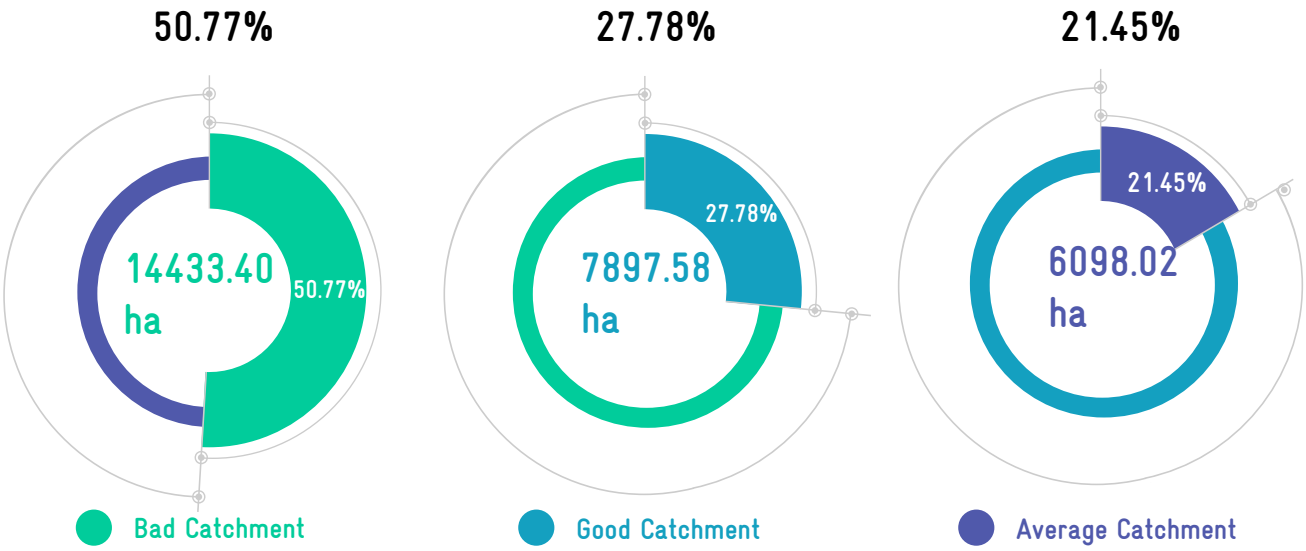


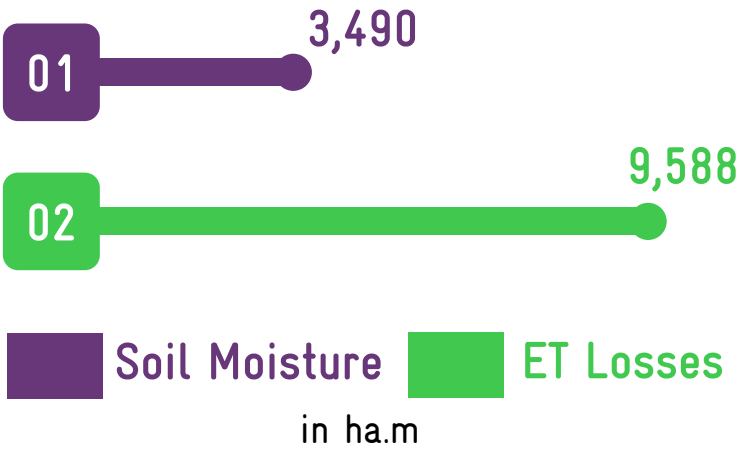
Figure 3.23. Catchment area

3.6.2.3 Soil moisture

Soil is an important medium to store the available water and the storage capacity varies 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 this Block because of its significant proportion of area under rain-fed cultivation. The annual average volumetric soil moisture of this Block (23%), is taken for estimating the amount of water stored as soil moisture which accounts to 3,490 ha.m

3.6.2.4 ET losses

The transformation of liquid state of water state from earth surface to vapour state of water to atmosphere is the ET loss. The loss of water through ET is important in water budgeting. The Block area witnessed an annual total ET loss of 9,588 ha.m during 2018-19, with a monthly average of 799 ha.m.



3.6.2.5 Macro nutrients

Nitrogen

The macro soil nutrients such as nitrogen and organic carbon falls under very low to medium category in all the soil samples tested. The available nitrogen is very low in 51.6 % of the samples tested while it was 43.3 % under low category and remaining is medium Nitrogen (Figure 3.24). According to soil resource map, this Block is identified as one of the nitrogen deficient Block (Ramanathapuram District profile 2020).

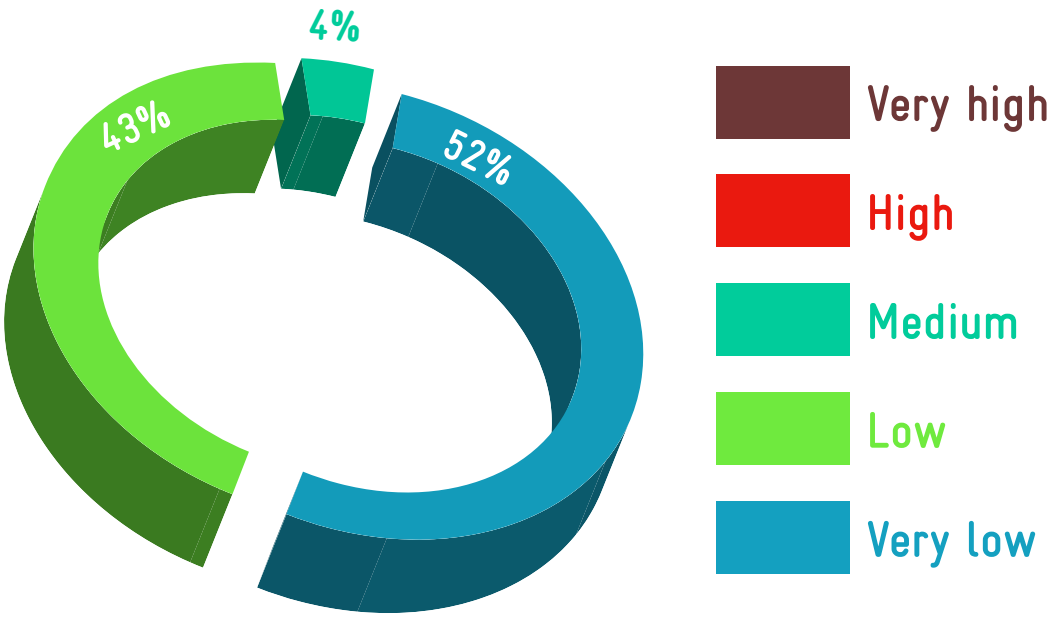


Figure 3.24. Status of available Nitrogen

Organic carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. Nearly 25.97 % of the soil samples tested fall under low category followed by 21.56 % which falls under very low category while less than 17.33 % falls under very high organic carbon (Figure 3.25). This indicates that the soil fertility is moderately poor.

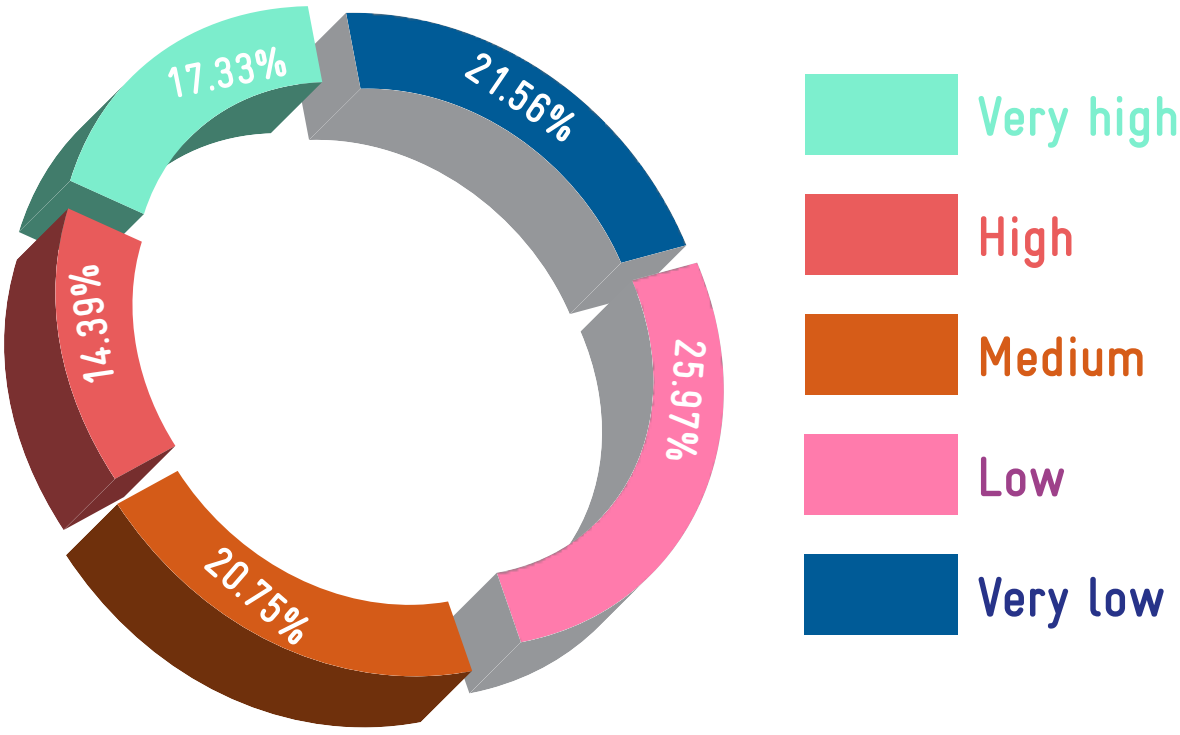


Figure 3.25. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro nutrients

This Block is one of the Nitrogen, zinc and ferrous deficient Block of Ramanathpuram District. The micro-nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 43.5 % and 56.55 % sufficient in the soils tested (Figure 3.26).

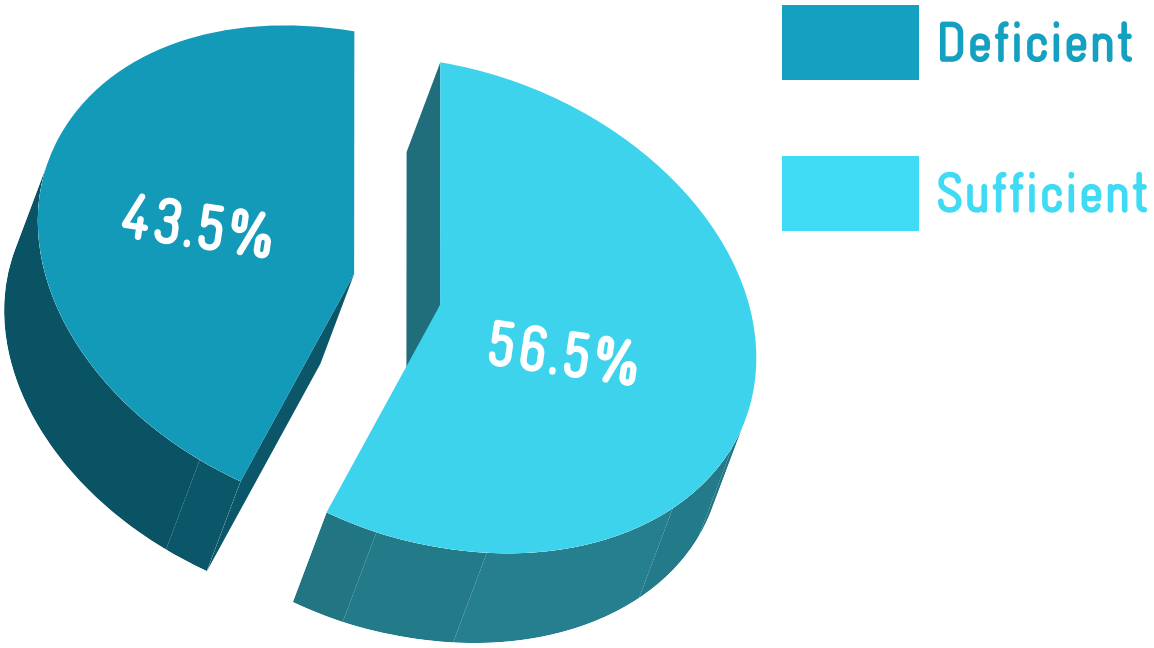


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 73.96 % of the soil is moderately alkaline in nature followed by 17.41 % is moderately acidic and rest is slightly acidic (Figure 3.27).

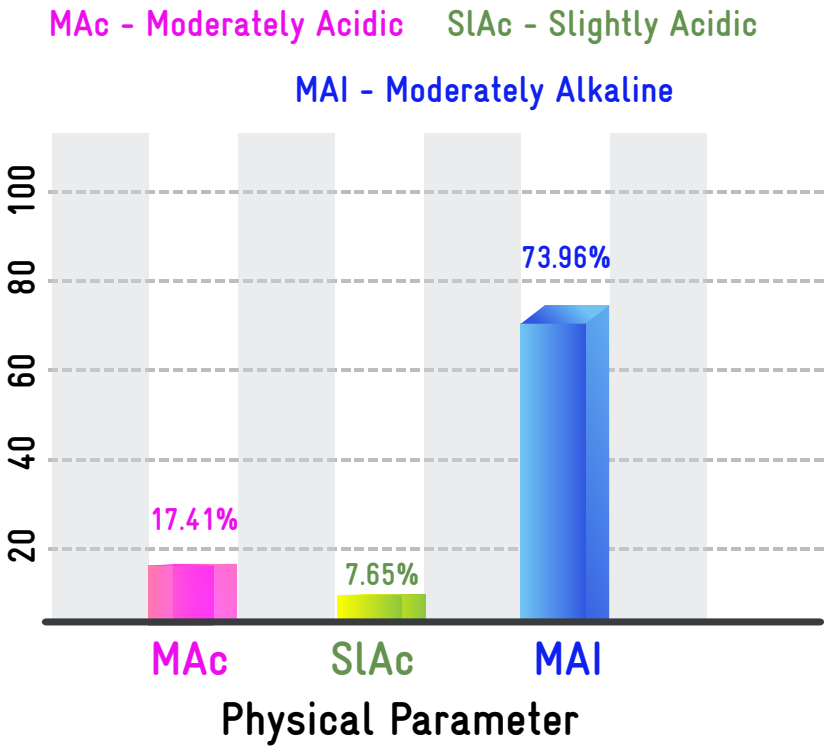


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

A total of 13,136 ha area is used for crop cultivation in which 55 % area is practiced with rain based water rest is the irrigation based sources. Paddy is a major crop with about 8,261 ha followed by oil pam while cultivation of vegetables is less in area Sugar cane, red gram, ragi, dry chilli, brinjal, water melon, ladies finger, gourds, flower crops, banana, guava, medicinal plants, lemon, mango, tomato, coconut are cultivated in less than one percent of the area.

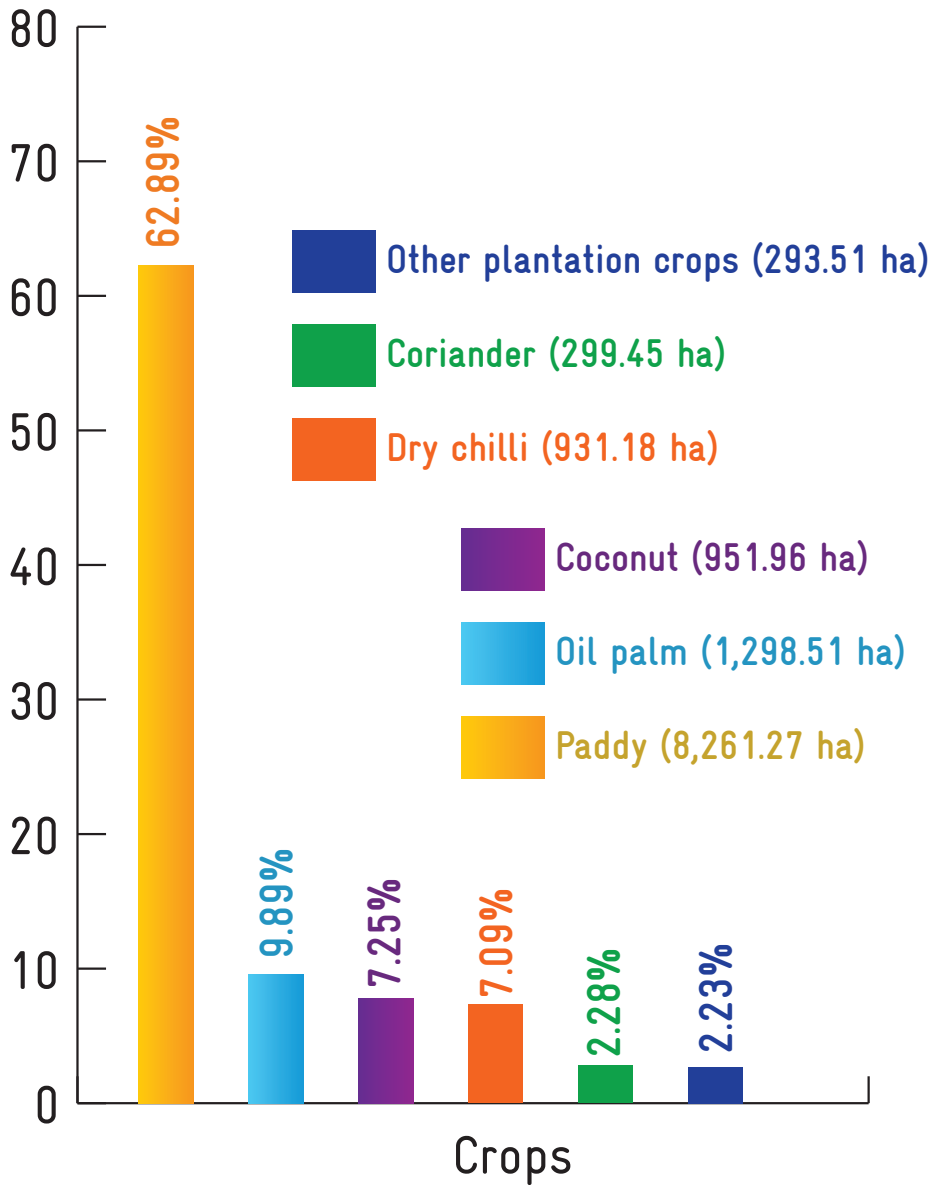


Figure 3.28. Crop pattern (included rain-fed and irrigation area)

3.6.2.9 Irrigation Methods

In case of the surface water resources, wild flooding is the primary method of irrigation. But in case of ground water resources, the predominant type of irrigation is control flooding. In the Block, 83 % of the irrigation is done by wild flooding and rest of irrigation is done by control flooding (Figure 3.29).

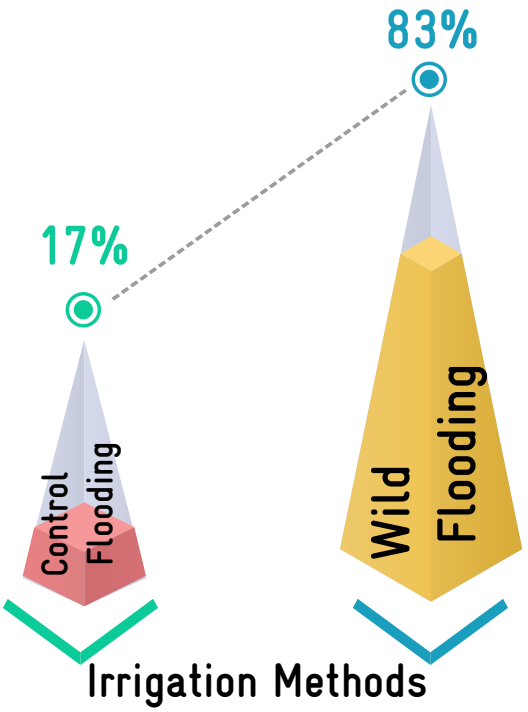


Figure 3.29. Irrigation methods

3.6.2.10 Means of Water Extraction

Water is extracted in two ways, one by gravity and another is by lifting. Water is drawn from surface water sources such as tanks, ponds etc., by using gravity method and that of ground water sources such as open well, hand pump, bore well by using lifting method. In the Block, 72 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

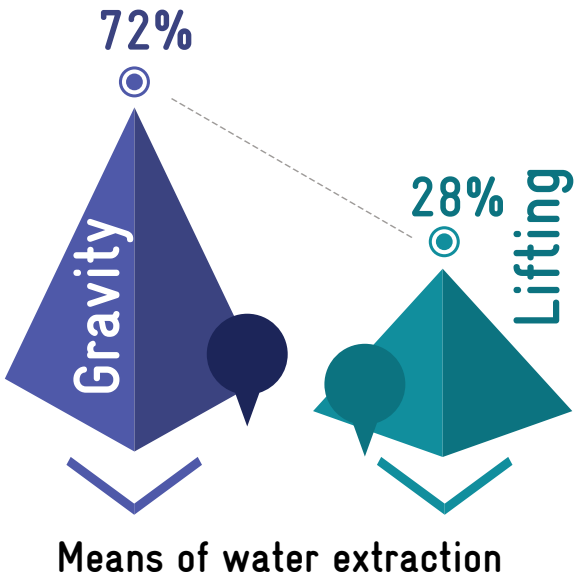


Figure 3.30. Means of water extraction

3.6.2.11 Livestock Details

This Block has considerable proportion of livestock resources about 70,296. Of which small ruminants sheep populations is high 34 % (23,900) followed by poultry of 29.71 % (20,883), while cattle population is about 9.13 % (6,419) (Figure 3.31). The total water requirement for livestock is 40 ha.m. Of the total water demand of 63 % is met through ground water and remaining is from surface water resources.

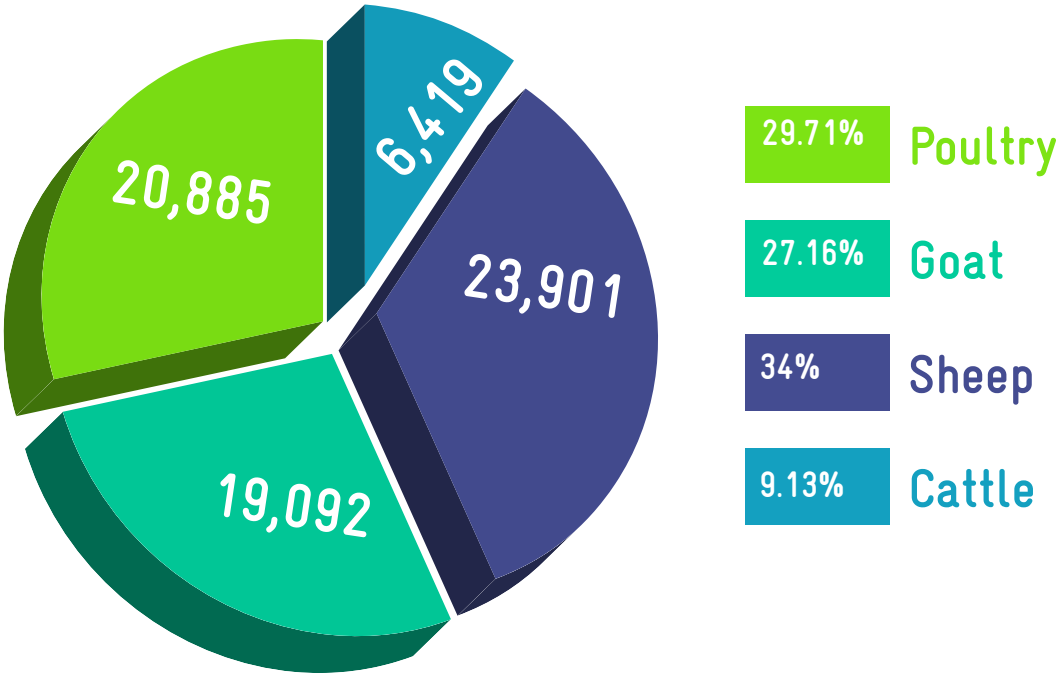


Figure 3.31. Livestock details

3.7 CWRM PLANNING ANALYSIS- SOCIO ECONOMIC

The demographic details such as population, gender, vulnerable population/ households, drinking and grey water details are collected from authentic primary and secondary sources and analyzed. Data of MGNREGA job holders is also taken for the analysis. Table 9 lists the demographic and socio-economic status of Thiruppullani Block. GP wise demographic and socio economic status are attached in Annexure 3.11.

TABLE 9. CWRM PARAMETER BASED SOCIO-ECONOMIC STATUS IN THE BLOCK

Key CWRM Parameters	Total
Geographical Area (ha)	28,516
Male Population (No.)	70,184
Female Population (No.)	68,217
Total Population (No.)	1,38,401
SC Population (No.)	30,513
Vulnerable population (No.)	30,514
Households (HH's) (No.)	36,945
Only one room HH's (SECC) (No.)	7,568
Female Headed HH's (SECC) (No.)	2,102
Vulnerable Households (SECC) (No.)	5,928

% of Vulnerable Households (%)	16
Registered MGNREGA Job cards (Persons)	24,807
Active person working in MGNREGA job Cards (Persons)	16,292
Drinking Water Sources (No.)	7,439
HH's have tap water connection for drinking water (No.)	13,308
HH's dependent on other sources for drinking water (No.)	10,951
Annual Greywater Generation (ha.m)	253

3.7.1 Population

The total population of this Block is 1.38 Lakhs in which the female proportion is slightly lower than male population. In the CWRM planning process due attention is given for the intersecting variables such as gender, class, caste and marital status and availability of safe drinking water resources. In the Block, about 22 % of the total population are under vulnerable population of SC (Figure 3.32).

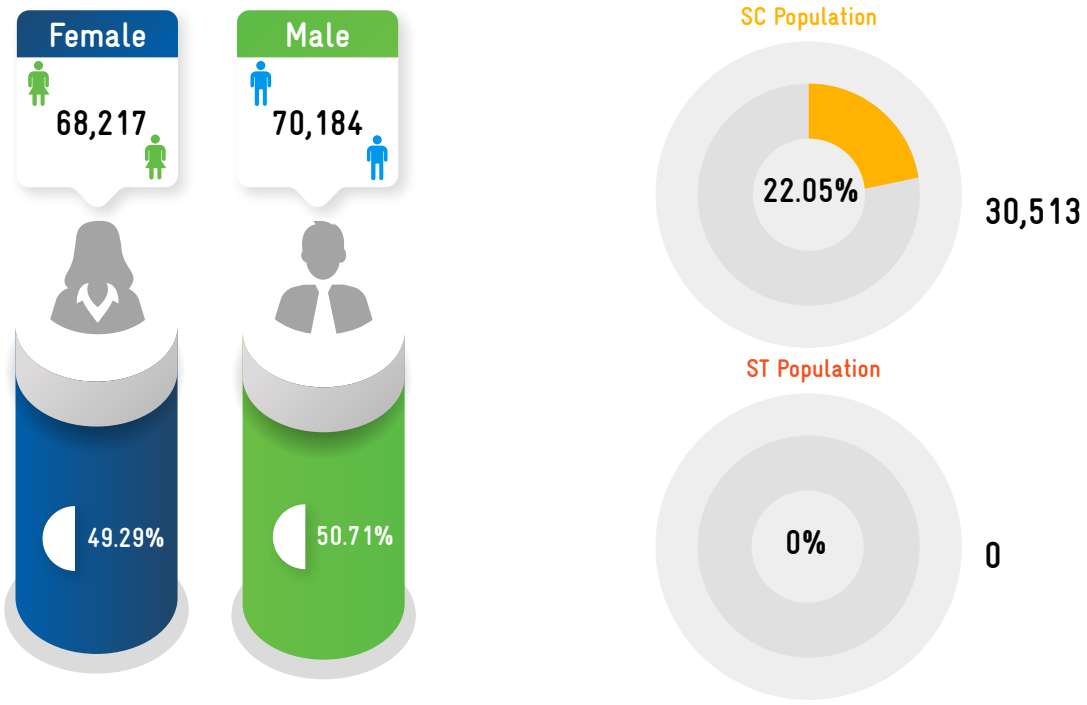


Figure 3.32. Population details

**population figure may differ from Census 2011 due to categorization of GPs based on revenue panchayat boundaries*

3.7.2 Households

There are a total of 36,945 households in which 20 % households have only one room, 28 % households are headed by women and 2.82 % are vulnerable households (Figure 3.33)

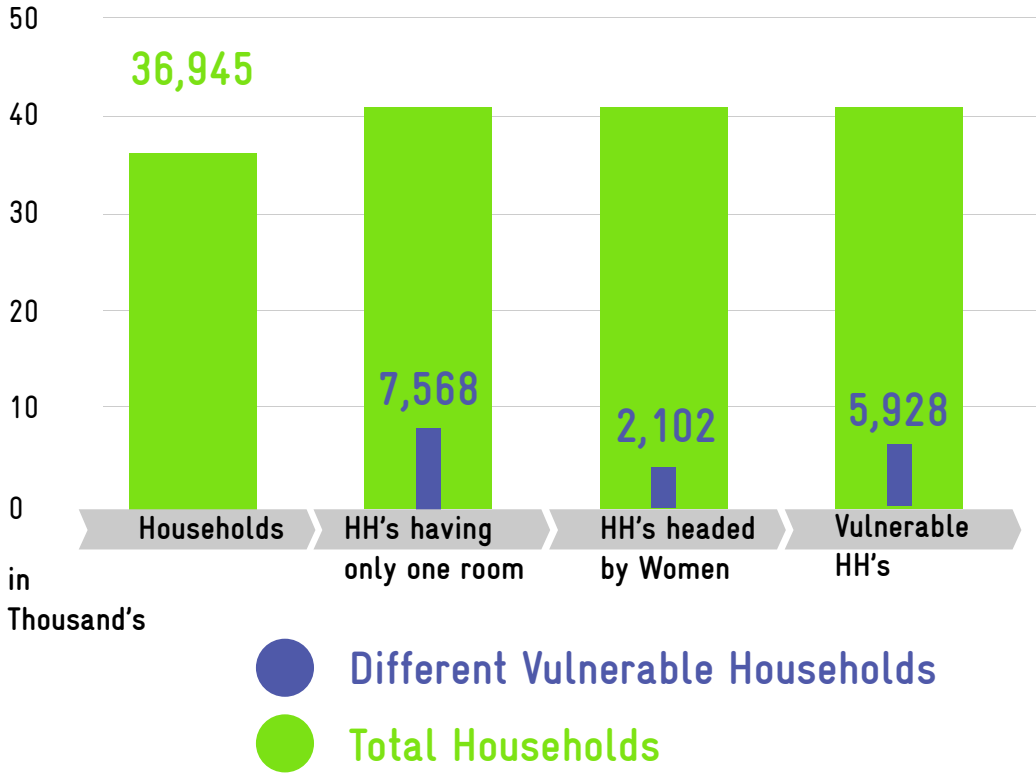


Figure 3.33. Details of households

3.7.3 3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 1.38 Lakhs, 24,807 are registered for job cards in Mahatma Gandhi NREGA scheme in which 65.6 % of the job cards are in active category (Figure 3.34)

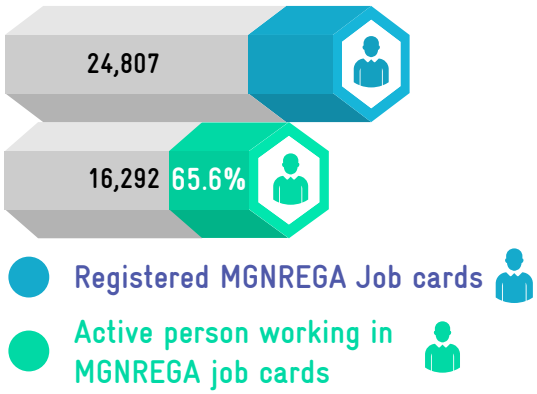


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 13,308 households have tap water connection and 10,951 households depend on other water sources for domestic use, where other sources include RTRWHS / Tanka (roof rain water harvesting systems, hand pump, open wells, bore wells, tank/ pond/ oorani, springs and river/ streams.

Tap water connection

13,308
Households

Other sources include RTRWHS / Tanka (Roof Rain Water harvesting Systems), hand pump, Open well, Bore well, Tank/ Pond/ Oorani, Springs and River/ Streams

10,951
Households

3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 253 ha.m which is available for reuse or recycle.

SPATIAL DATA DERIVED AREA SCOPE FOR TREATMENT MEASURES IN GP'S

Morphology

Melamadai, Alankulam, Ekkakudi, Vannangundu

Wasteland

Thiru Uthirakosamangai, Sethukkarai, Mayakulam

Soil erosion

Panaiyadiyendhal, Komboothi, Alankulam

Physicochemical parameters

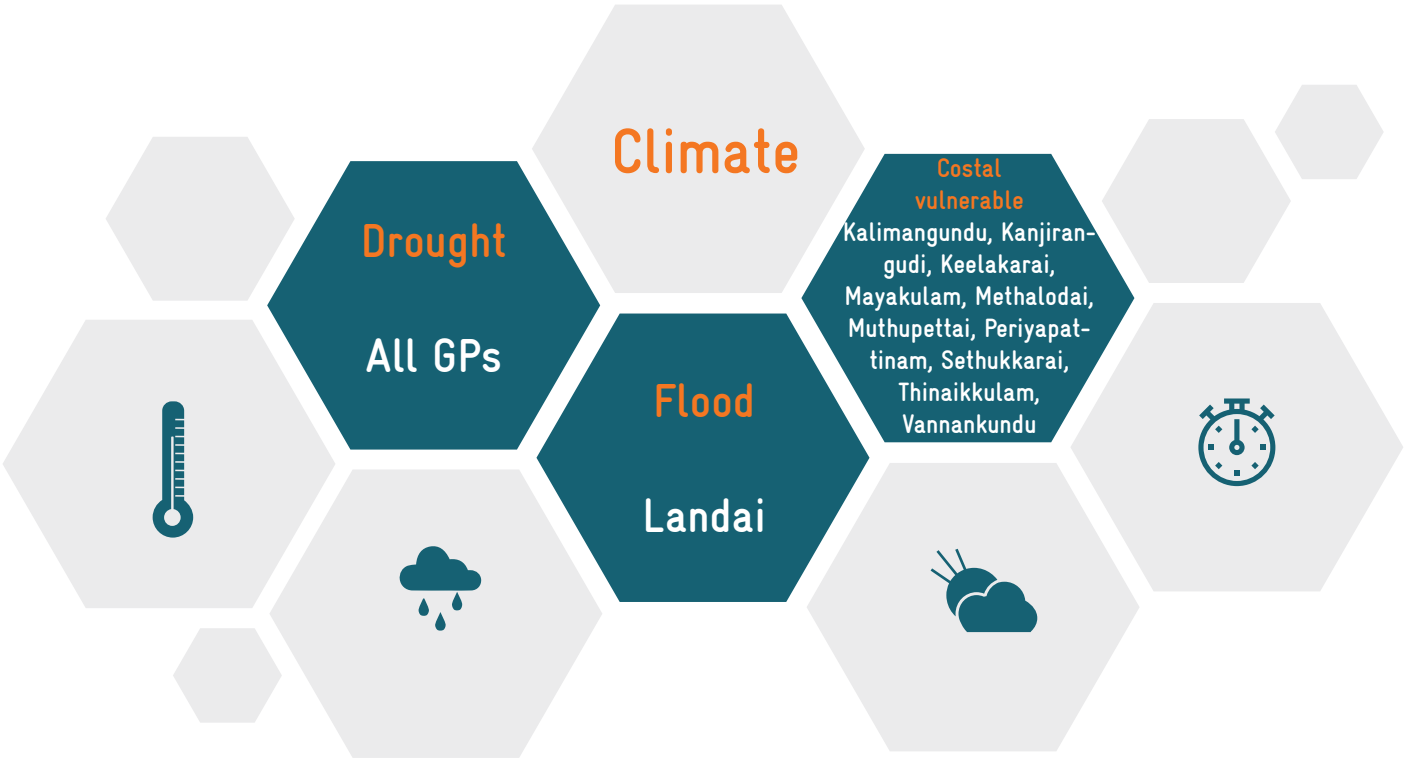
Thinaikkulam, Mayakulam, Methukarai, Kalimankundu, Methalodai

Ground water prosperity

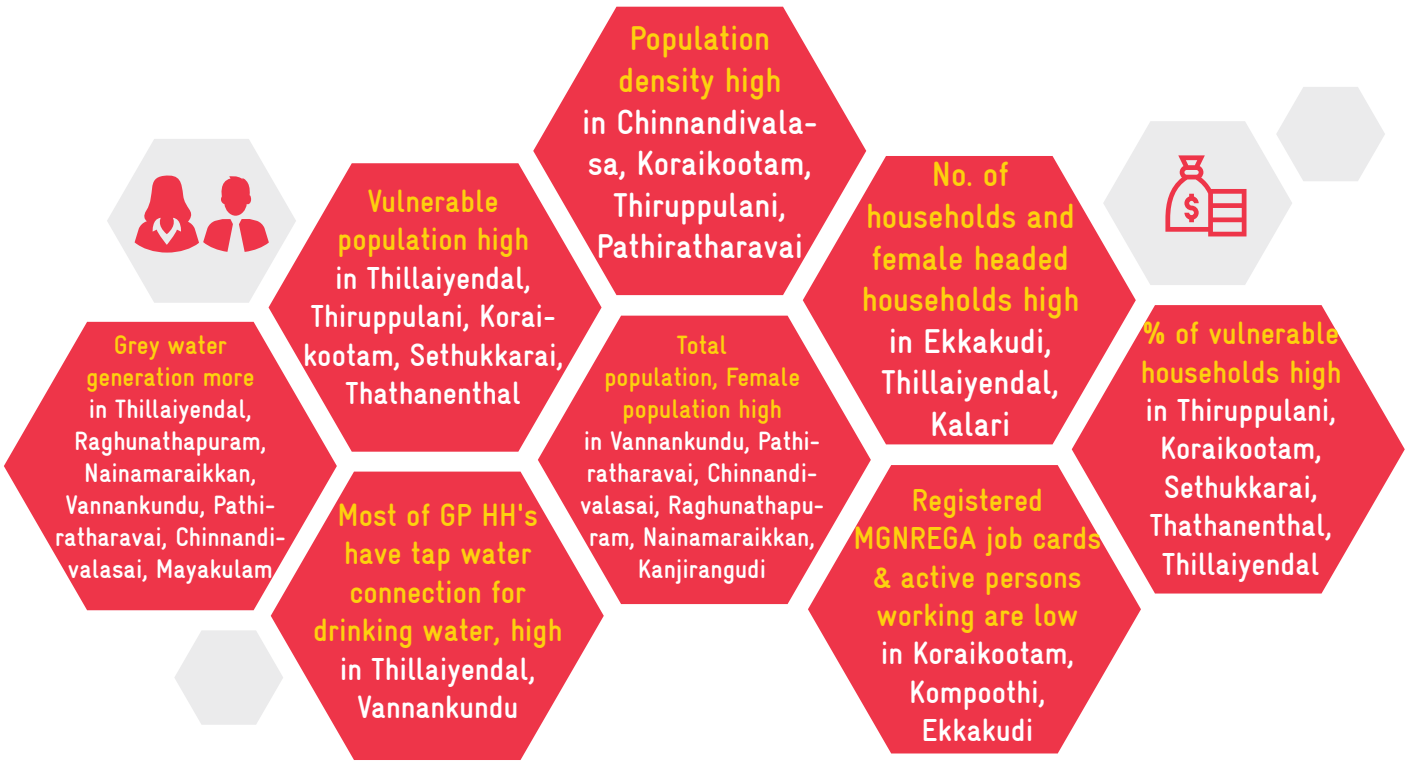
Landai, Mayakulam, Kutha-kottai, Pathiratharavai, Uthiravai, Kalimangundu, Thadhanendhal

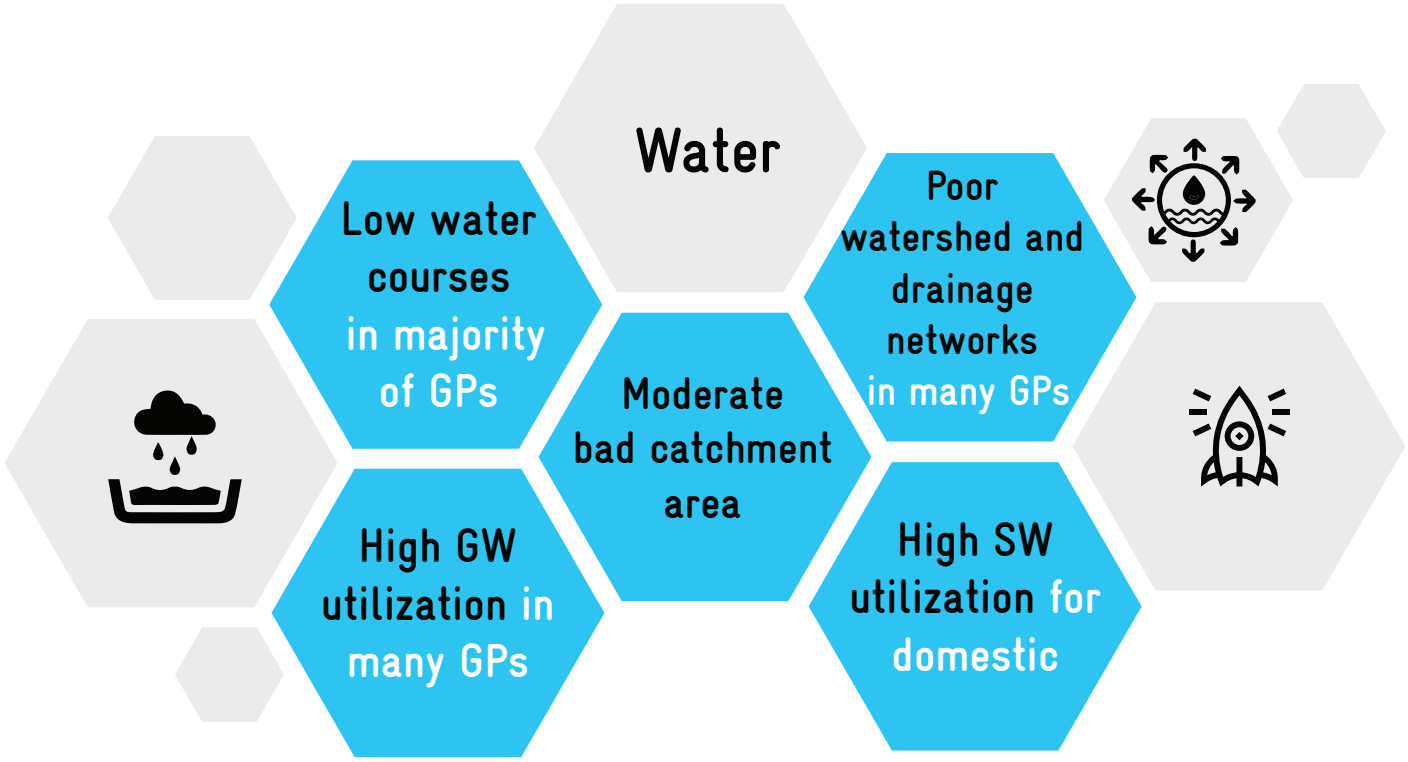
Salt affected area

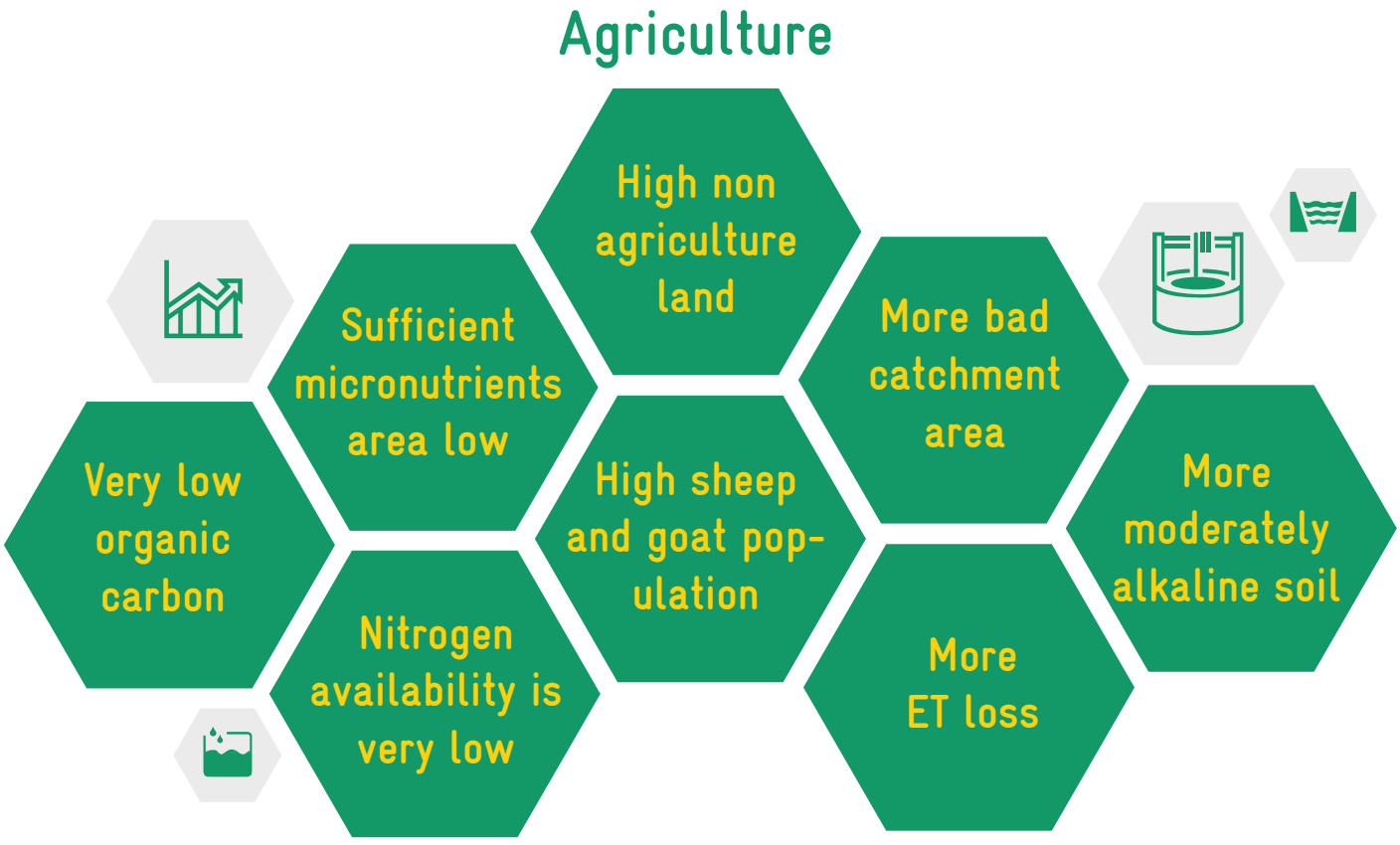
Thiruppulani_TP, Velanoor, Koraikootam, Thinaikulam



Socio economic




Water
Low water courses in majority of GPs
Poor watershed and drainage networks in many GPs
Moderate bad catchment area
High GW utilization in many GPs
High SW utilization for domestic


Agriculture
High non agriculture land
Sufficient micronutrients area low
More bad catchment area
Very low organic carbon
High sheep and goat pop-ulation
More moderately alkaline soil
Nitrogen availability is very low
More ET loss


MGNREGS 2019-20

கெடுப்பதூஉம் கெட்டார்க்குச் சார்வாய்மற் றாங்கே
எடுப்பதூஉம் எல்லாம் மழை

குறள் - 15

Destruction it may sometimes pour
But only rain can life restore

Thirukkural - 15

CHAPTER 4

4 VULNERABILITY RANKING OF GP

The vulnerability assessment has been carried out using IPCC methodology. IPCC defined vulnerability as 'the propensity or predisposition to be adversely affected' (IPCC 2014). Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and the lack of capacity to cope and adapt. It is determined by sensitivity and adaptive capacity of the system (Figure 4.1).

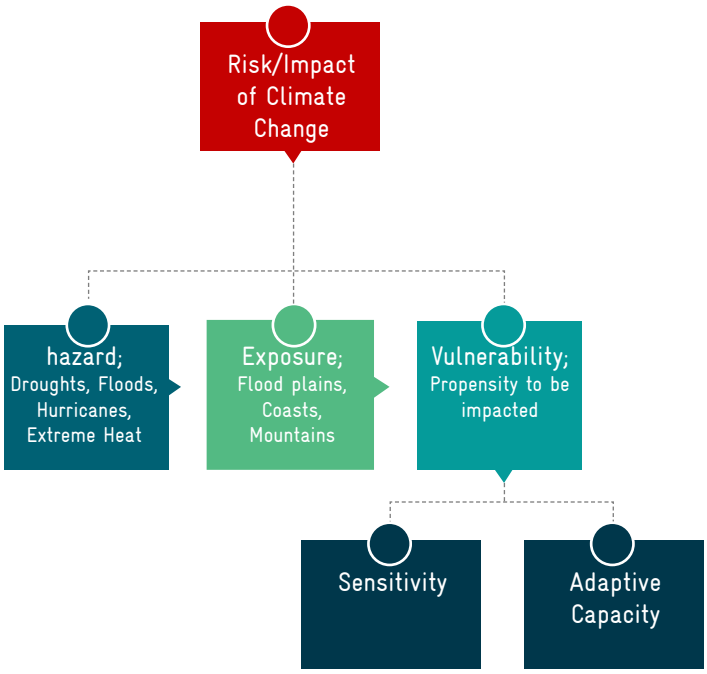


Figure 4.1. Vulnerability of the system as defined by IPCC

Generally, vulnerability assessments are made to identify

- current and potential hotspots
- entry points for intervention
- drivers of vulnerability
- priorities adaptation interventions

The CWRM parameters which been explored through rigorous study were considered here to address the key water challenges at GP level. About 73 spatial and non-spatial parameters/ indicators under 4 dimensions via Climate (3), Water (28), Agriculture (31) and Socio-demographic (11) are categorized into adaptive capacity, sensitivity and exposure indicators for vulnerability analysis as per IPCC norms. Table 10 lists CWRM parameters/ indicators, its rationale to vulnerability, source of data and its linkage with WASCA TN's primary 18 indicators.

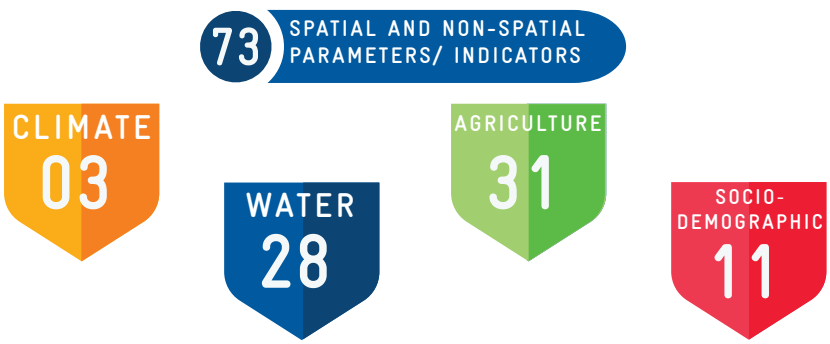


TABLE 10. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

	Key CWRM Parameter	Vulnerability relationship
Climate	Drought	Climate risk/Sensitivity
	Flood locations	
	Coastal vulnerable locations	
Water	**Canal Network (in m)**	
	Length of main canal	Adaptive capacity
	Length of minor canal	
	Length of distributaries	
	Water courses (Field channels)	
	Traditional water bodies (in No.)	
	No of Tanks	Adaptive capacity
	No of Oranis	
	Other Surface Water Bodies	
	Irrigation Facilities (in ha)	
	Area under Tank Irrigation	Sensitivity
	Area under Canal Irrigation	
	Area under Open & Tube Well Irrigation	
	Catchment Area wise Available Runoff (ha.m)	
	Good Catchment Area	Sensitivity
	Average Catchment Area	
	Bad Catchment Area	
	Watershed and Drainage Networks	
	Length of Natural Drainage Lines	Adaptive capacity
	Number of Natural Drainage Lines	
	Number of Micro-watersheds	
	Water demand (ha.m)	
	For Humans	Sensitivity
	For Livestock	
	For Agriculture	
	% GW utilization for Drinking	
	% GW utilization for Livestock	
	% GW utilization for Agriculture.	
	% SW utilization for Drinking	
	% SW utilization for Livestock	
	% SW utilization for Agriculture	
	Water Quality	
	Water Quality Index	Sensitivity
	Sea Mixing Index	
	Salinity Index	
Agriculture	**Area under land resources (in ha)**	
	Forest land	Adaptive capacity
	Non-Agricultural Uses	
	Barren & Un-cultivable Land	
	Permanent pastures and Other grazing land	
	Land under miscellaneous tree crops etc.	
	Cultivable wasteland	
	Fallows land other than current fallows	Sensitivity
	Current fallow land	
	Unirrigated land	

Agriculture	Area irrigated by source	Sensitivity
	Land under catchment area (ha)	
	Good Catchment	Adaptive capacity
	Average Catchment	
	Bad Catchment	Sensitivity
	Crop Area details (in ha)	
	Irrigated Area	Sensitivity
	Rainfed area	
	Soil Resources: Status of available Nitrogen (in %)	
	Very low to low	Sensitivity
	Status of Organic Carbon (in %)	
	Very low to low	Sensitivity
	Status of Soil Micro Nutrients (in %)	
	Deficient	Sensitivity
	Status of Physical condition of the soil (in %)	
	Highly acidic/alkaline	Sensitivity
	Slightly acidic	Adaptive capacity
	Neutral	
	Moderately alkaline	
	Soil Texture (in %)	
	Clay	Sensitivity
	Fine	Adaptive capacity
	Coarse loamy	
	Soil Water Permeability (Low, Moderate, high)	
	Soil moisture and ET (in ha.m)	
	Estimated soil moisture	Adaptive capacity
	ET losses	Sensitivity
	Means of Water Extraction (in %)	
	Lifting	Sensitivity
	Irrigation Methods (in %)	
	Wild flooding	Sensitivity
	Livestock (in No.)	
	Livestock density (cattle, sheep, Goat, poultry)	Sensitivity
Socio economic	**Demographic (in %)**	
	Female Proportion	Sensitivity
	Vulnerable population Proportion	
	Population density (persons per ha)	
	Economic (In %)	
	Only one room HH's	Sensitivity
	Female headed HH's	
	Vulnerable households	
	MGNREGA (in %)	
	Registered MGNREGA Job cards	Adaptive capacity
	Active person working in MGNREGA job Cards	
	Water accessibility (in %)	
	HH's have tap water connection for drinking water	Adaptive capacity
	HH's dependent on other sources for drinking water	Sensitivity
	Annual Greywater Generation (in ha.m)	

The identified indicators are from different sources and measured in different units. As the vulnerability assessment is about ranking, the indicators have to be in common units. This is done through normalization. The normalized indicators are aggregated and categorized to different vulnerability levels very high, high, medium, low and very low category. The vulnerability assessment methodology is given in Annexure 4.1 and the GPs categorized based on vulnerability scores are shown in Figure 4.2. Kanjirangudi, Landai, GPs have very high rural water security vulnerability to climate risks. Muthupettai, Chinnandivalasai, Periyapattinam, Pathiratharavai, Nainamarkkam, Raghunathapuram, Panayadiyenthal, Vellamaruchikatti, and Alangulam, GPs have high vulnerability. Komboothi, Utrakosamangai and Kalari GPs have very low vulnerability.

Upto	Category	Color range
0.536	Very High	
0.509	High	
0.483	Medium	
0.457	Low	
0.431	Very low	

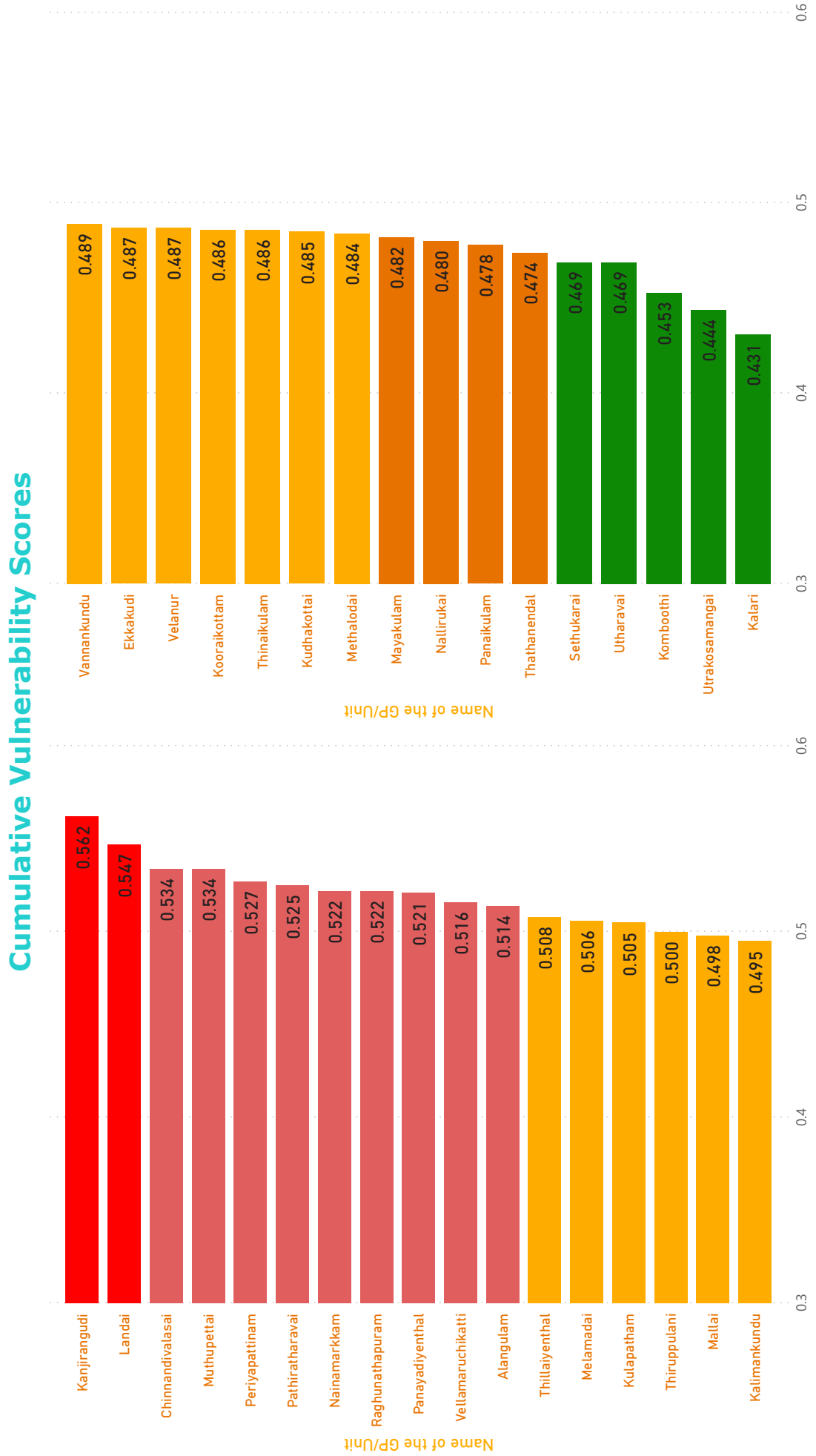


Figure 4.2. Final cumulative vulnerability scores

Sectoral vulnerability

The vulnerability indices were calculated within climate risks, water resource, agriculture and socio-economic dimensions and are shown in Figure 4.3 to identify area wise vulnerable GPs.

Climate risks vulnerability

The climate risk vulnerability index shows that all GPs in this Block are affected with droughts in last decades. Landai GP have moderate flood vulnerability. Coastal vulnerability hot spots : Kalimangundu, Kanjirangudi, Keelakarai, Koraikuttam, Mayakulam, Methalodai, Muthupettai, Periyapattinam, Sethukarai, Thinaikkulam, Vannankundu, Vannankundu

KALIMANGUNDU, KANJIRANGUDI, KEELAKARAI, KORAIKUTTAM, MAYAKULAM, METHALODAI, MUTHUPETTAI, PERIYAPATTINAM, SETHUKARAI, THINAIKKULAM, VANNANKUNDU, VANNANKUNDU

Water resource vulnerability

The water resources vulnerability index shows that Raghunathapuram, Kanjirangudi, Melamadai, Chinnandivalasai, Pathiratharavai, Nainamarkkam, Kulapatham, Thillaiyenthal, Kudhakottai, Periyapattinam GPs have high vulnerability

RAGHUNATHAPURAM, KANJIRANGUDI, MELAMADAI, CHINNANDIVALASAI, PATHIRATHARAVAI, NAINAMARKKAM, KULAPATHAM, THILLAIYENTHAL, KUDHAKOTTAI, PERIYAPATTINAM

Agriculture resources vulnerability

In agriculture and allied sectors, Landai, Muthupettai, Vellamaruchikatti, Panayadiyenthal, Panaikulam, Mallai, Alangulam and Periyapattinam GPs have high vulnerability

LANDAI, MUTHUPETTAI, VELLAMARUCHIKATTI, PANAYADIYENTHAL, PANAIKULAM, MALLAI, ALANGULAM, PERIYAPATTINAM

Socio-economic vulnerability

Thiruppulani, Kooraikottam, Vellamaruchikatti, Chinnandivalasai, Sethukarai, Kanjirangudi, Thathanendal GPs have high socio economic vulnerability

THIRUPPULANI, KOORAIKOTTAM, VELLAMARUCHIKATTI, CHINNANDIVALASAI, SETHUKARAI, KANJIRANGUDI, THATHANENDAL

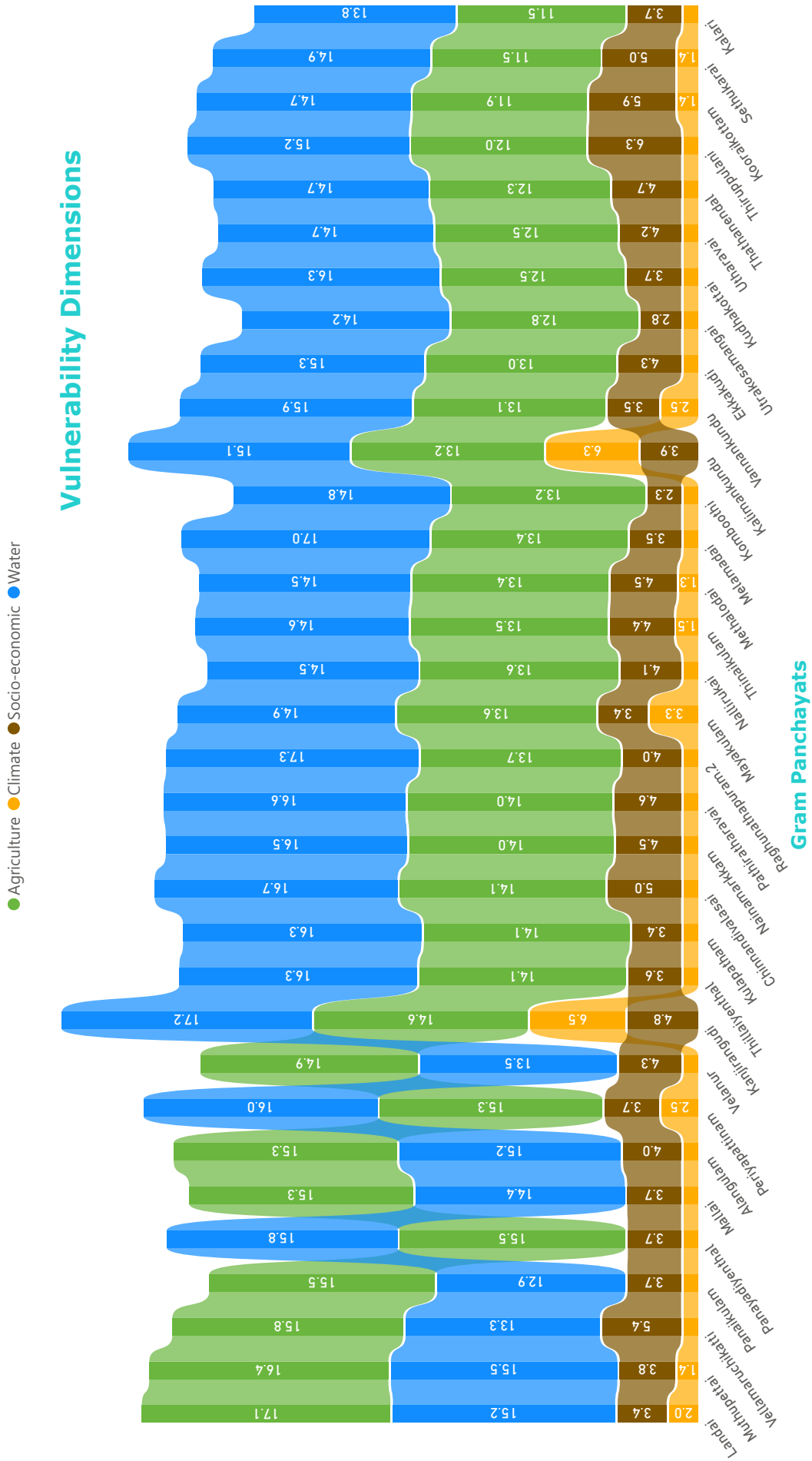
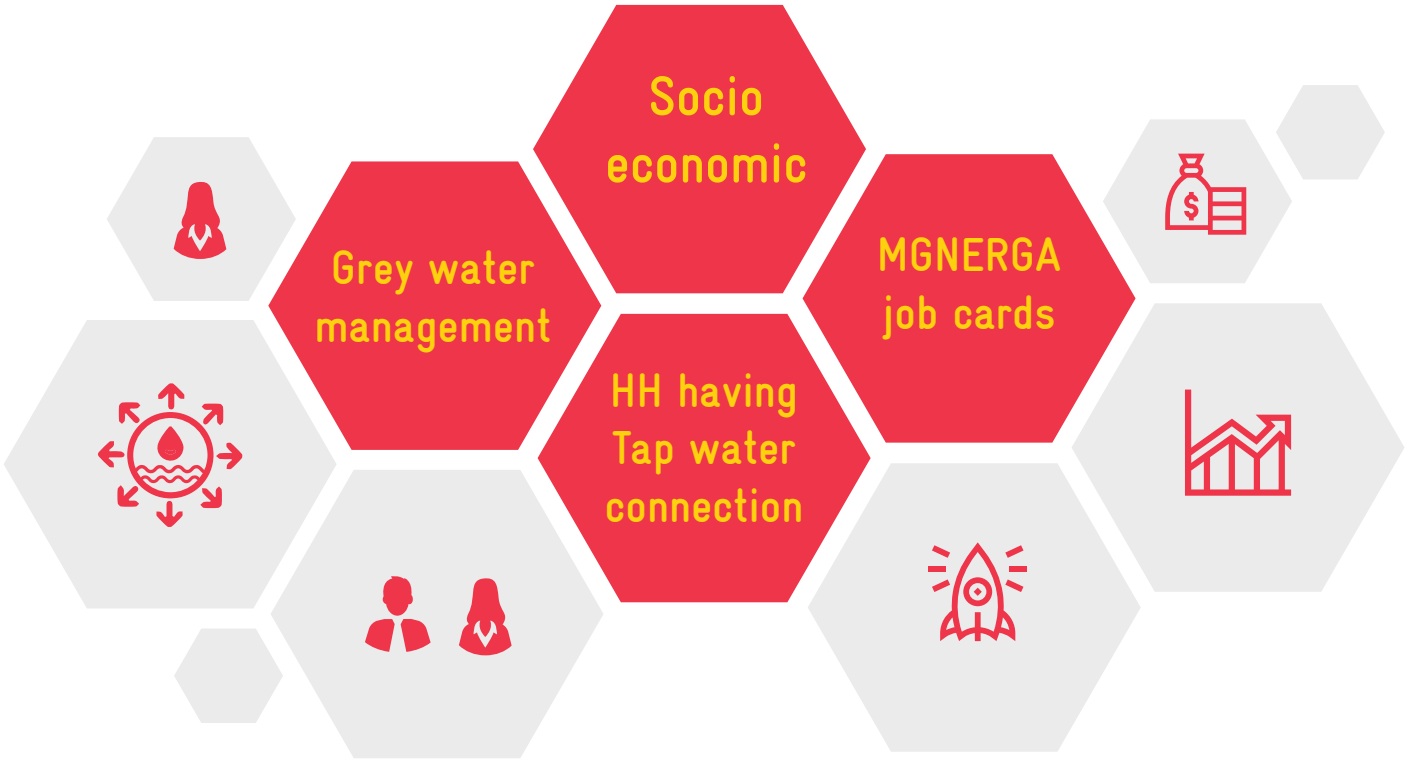
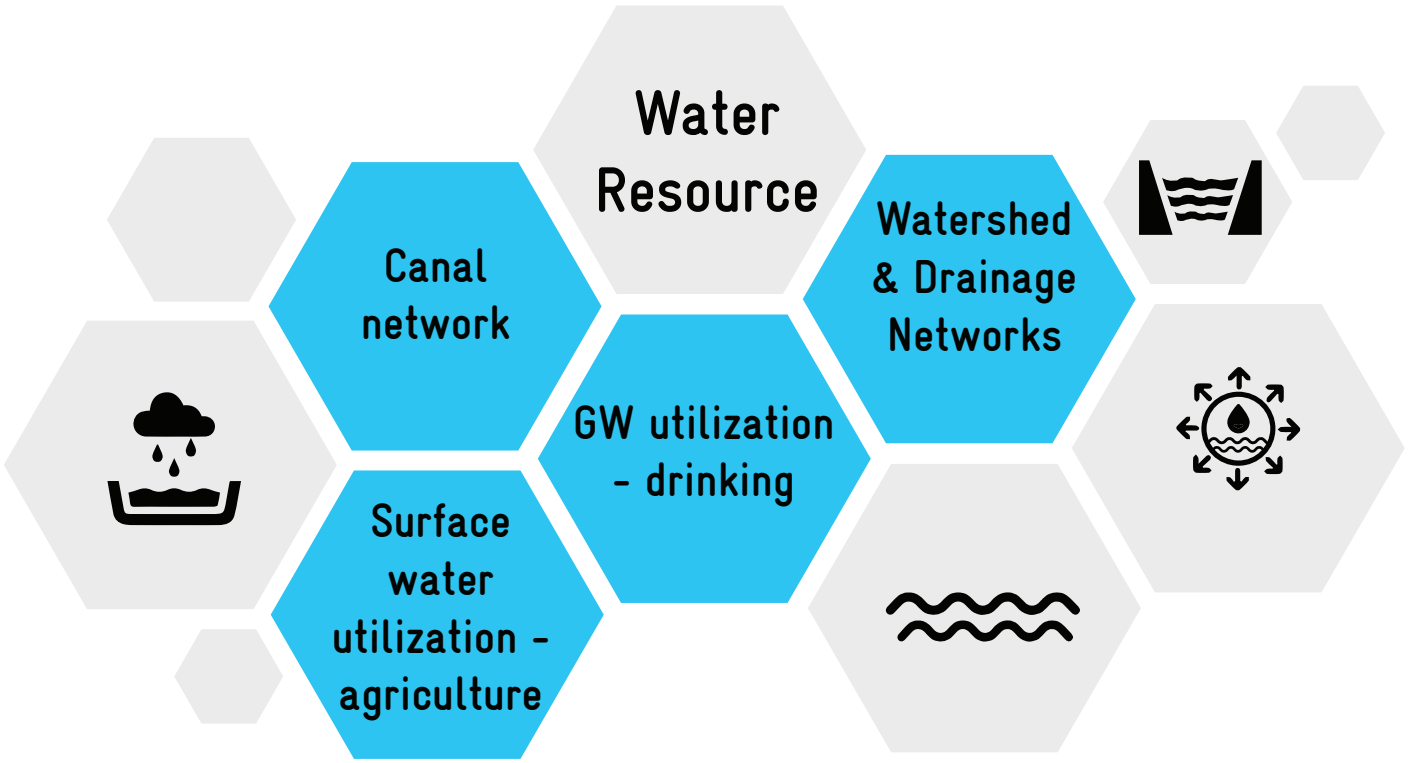
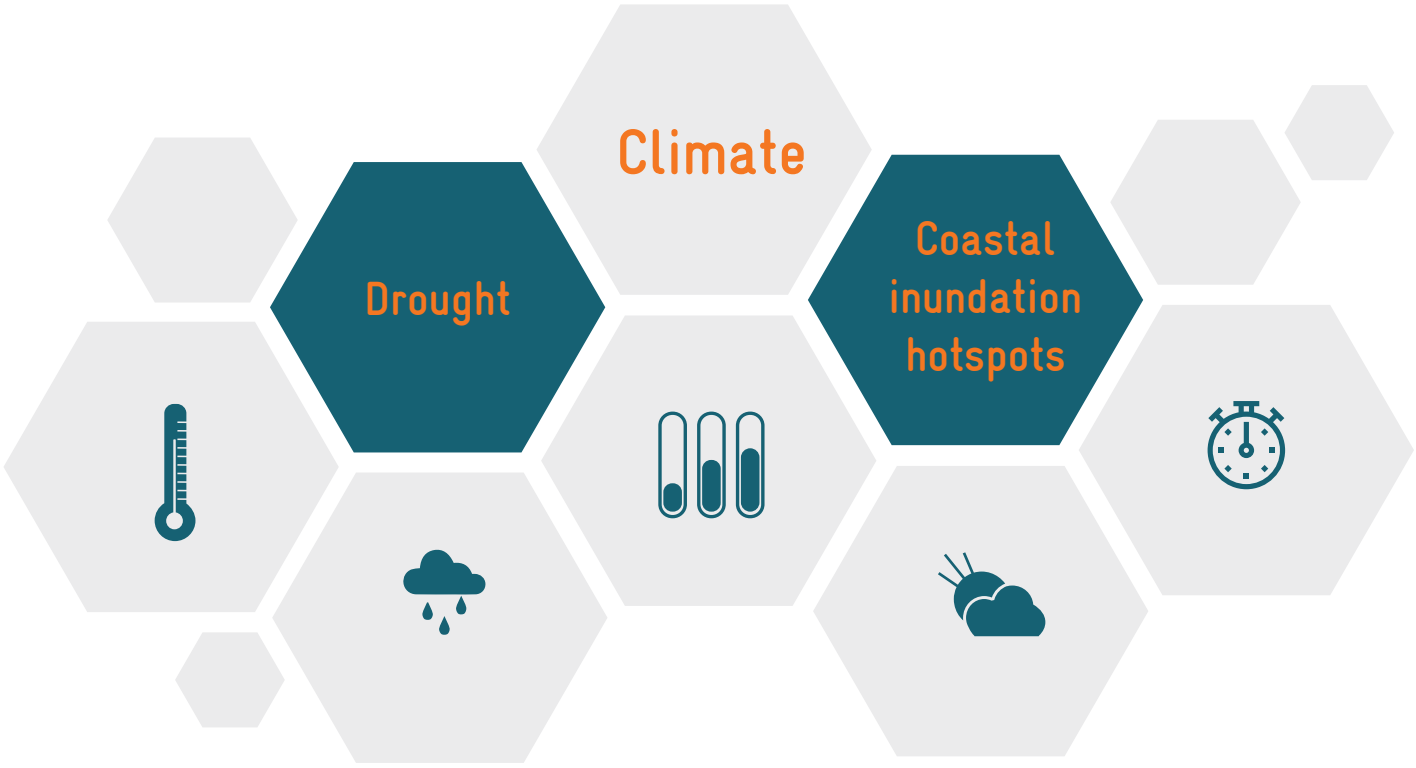


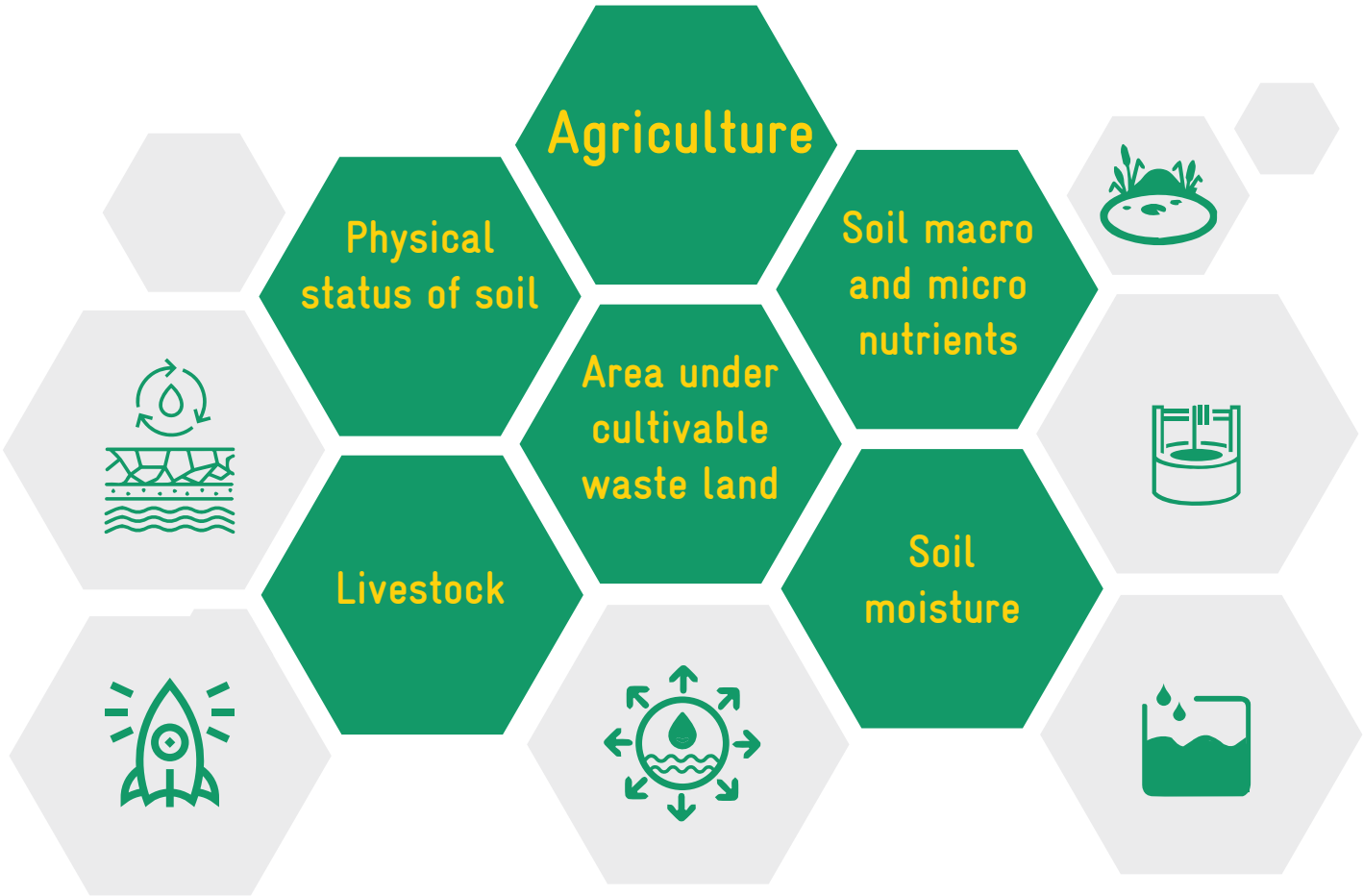
Figure 4.3. GP wise vulnerability dimensions

Contributing indicators to the total vulnerability









Based on the vulnerability assessment, high attention has been provided to identify more shelf of works/actions in the resource management in order to reduce the vulnerability and increase its adaptive capacity towards climate change.

விசும்பின் துளிவீழின் அல்லால்மற் றாங்கே
பசும்புல் தலைகாண்பு அரிது

குறள் - 16

No grassy blade its head will rear
If from the cloud no drop appear

Thirukkural - 16

CHAPTER 5

KEY WATER ACTIONS IN THIRUPPULLANI BLOCK UNDER MAHATMA GANDHI NREGS, CONVERGENCE

5 PROPOSED TREATMENT ACTIONS UNDER WASCA, CWRM AND CRM IN THE BLOCK

After identifying the key water issues at GP level through vulnerability analysis, the area for key water action treatments were proposed. The comprehensive and holistic understanding of the key water challenges adopting the eco-system approach enable to identify water action works in public and common land (afforestation, soil and water conservation, improving the traditional water storage and catchment assets etc.,), agriculture and allied sector (farm ponds, artificial recharge structures, on-farm plantation, irrigation methods, livestock - fodder development etc.,) and rural infrastructure (on safe drinking water and efficient handling of grey water).

5.1 THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 28,429 ha available land in Thiruppullani Block, 8,795 ha (31 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 4,843 ha of land under miscellaneous tree crops (85 % of total area), followed by 1,186 ha of unirrigated land (17.5 % of total area) while least of 30 % area of fallow land other than current fallow was considered for treatment. The detailed land wise proposal for WASCA treatments is given in the Table 11 and Figure 5.1. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 11. THE PROPOSED AREA FOR WASCA TREATMENT

Land use	Total available land (ha)	WASCA proposed treatment area (ha)
Land Under Miscellaneous Tree Crops etc.	5,697	4,843
Unirrigated Land	6,749	1,186
Irrigated by Source	5,921	1,150
Non-Agricultural Uses	7,897	952
Cultivable Waste Land	401	341
Current Fallow land	1,456	232
Fallows Land other than Current Fallows	308	92
Total	**28,429**	**8,795**

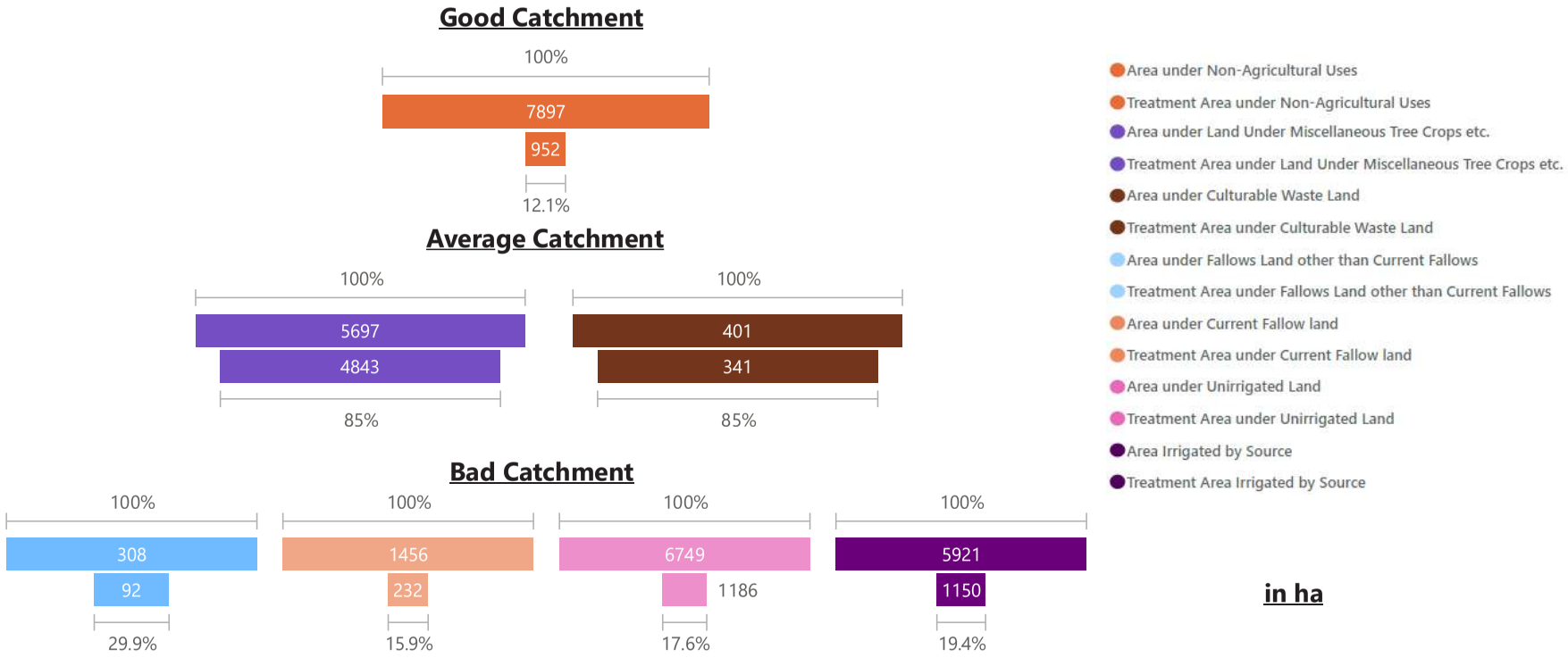


Figure 5.1. WASCA treatment area in percentage

Expected Runoff Conservation after WASCA treatment

The productive developmental activities that were taken up in the WASCA proposed areas are termed as Key Water Actions. With the above proposed treatment area, the expected runoff harvested due to WASCA intervention would be around 1,825 ha.m which is 41 % of the total runoff. Of the expected runoff conservation, the highest of 44 % average catchment area was considered for treatment followed by 39.67 % of good and rest from bad catchment (Figure 5.2).

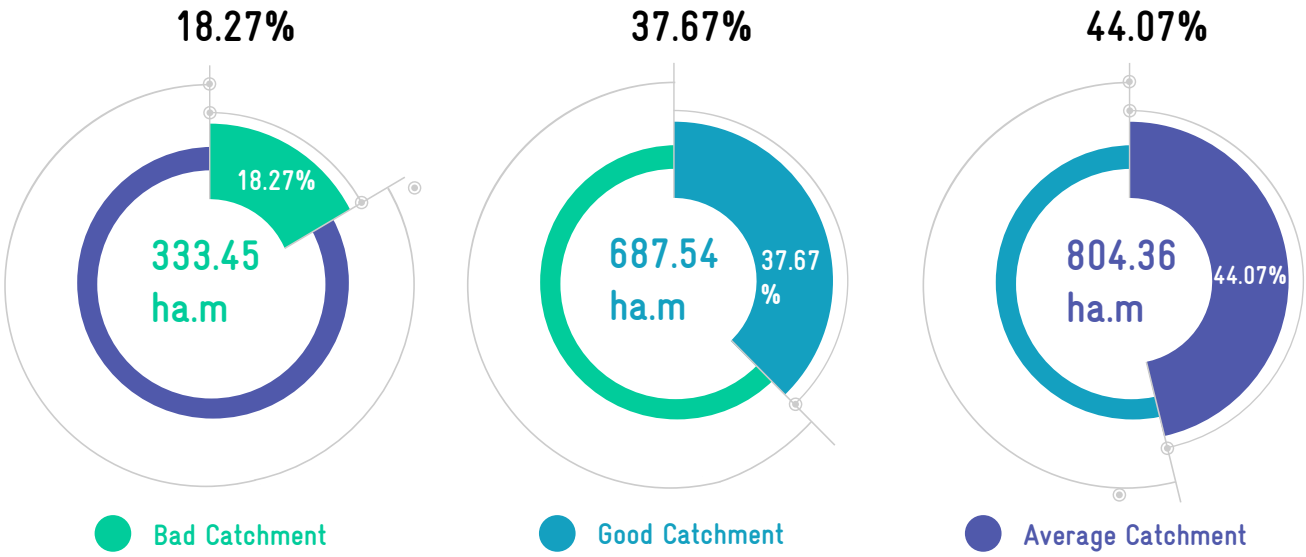


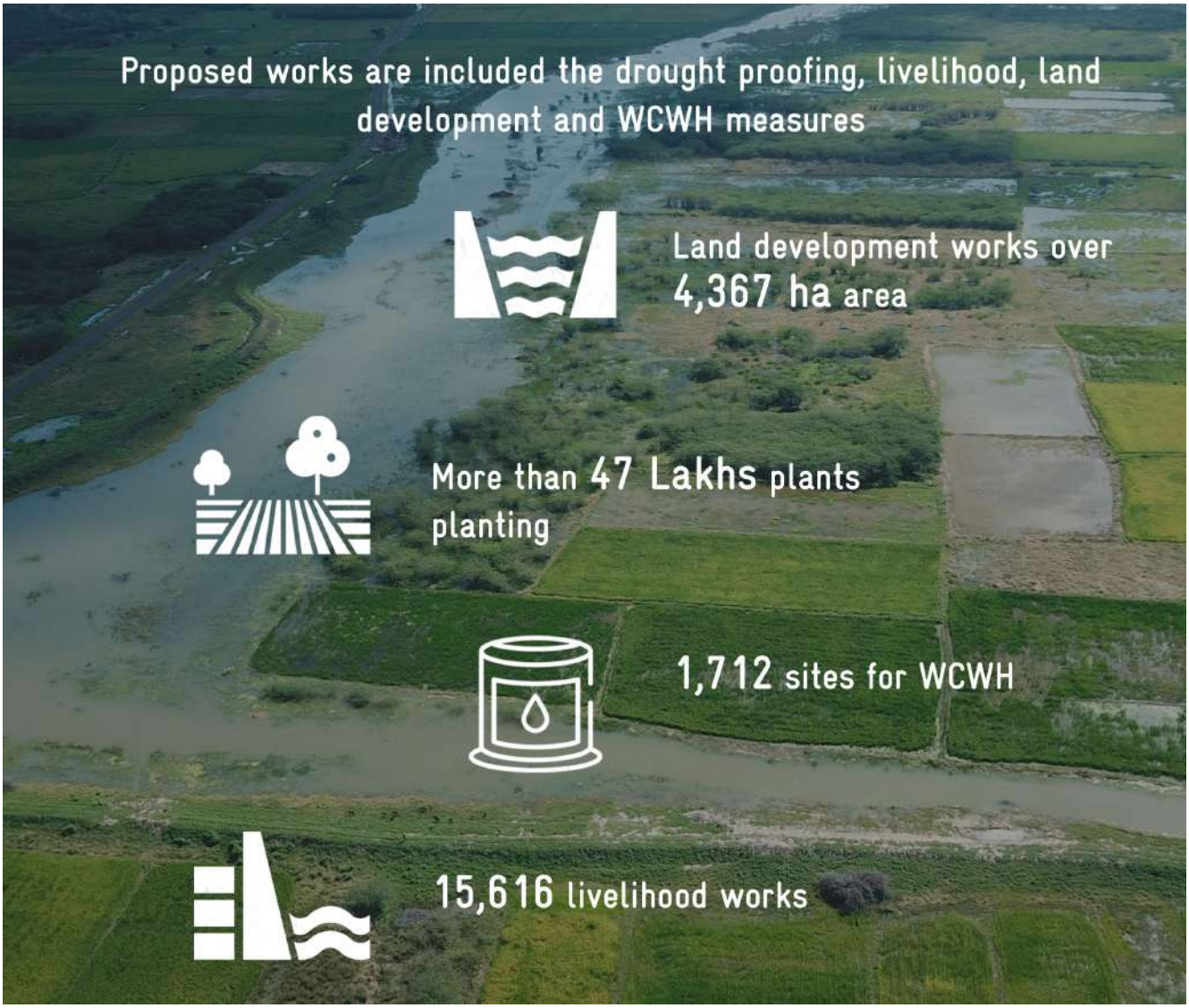
Figure 5.2. Expected conservation after WASCA treatment

The GP wise expected runoff conservation after completion of WASCA treatment is shown in Figure 5.3 (Annexure 5.2).

All the works are proposed based on watershed and livelihood approach. The summary statistics of all proposed works are given below. The detailed list of works for all GP are attached in Annexure 5.3.

Work	No.	Extent
Afforestation in Public/common lands (ha)	761859	952
Artificial Recharge Structure (No.)	1157	-
Avenue plantation (m)	33276	133081
Azolla units - Individual (No.)	162	-
Block Plantation (Community) (ha)	3731669	5183
Canal Bund Plantation(ha)	14098	56390
Cattle Shelters (No.)	162	-
Cattle Trough (No.)	162	-
Composting (No.)	605	2660
Construction of Farm Ponds - Individual (No.)	605	-
Contour Continous Bunds for Afforestaion area (m)	190465	952
Drainage Line Treatment (m)	14063	56242
Dry land Horticulture/Agro-forestry - Individual (ha)	532	1330
Farm Bunding with Boundary Trenches - Individual (ha)	1064	2660
Fodder development - Community & Individual	-	1608
Goat Sheep Shelters (No.)	-	17150

Irrigation Channel Plantation (m)	5898	23576
Land development - Individual (ha)	303	755
Linear Plantation (m)	14381	57525
Micro Irrigation (ha)	462	1150
NADEP Vermi compost (No.)	-	1608
Nursery Development (No.)	197110	39422
Poultry Shed (No.)	384	3850
Restotaration of water bodies:a.PWD and Tanks (Number)	62	-
Restotaration of water bodies:b. Ooranis (Number)	361	-
Restotaration of water bodies:c. Ponds (Number)	-	-
Roof Rain Water harvesting (No.)	66	-
Soak Pits (Community) (No.)	391	-
Soak Pits (Individual) (No.)	3946	-
Tanka - community level (No.)	1	-
Water Course - Irrigation Channels - Desilting (m)	23576	-
Total	**4996820**	**406094**



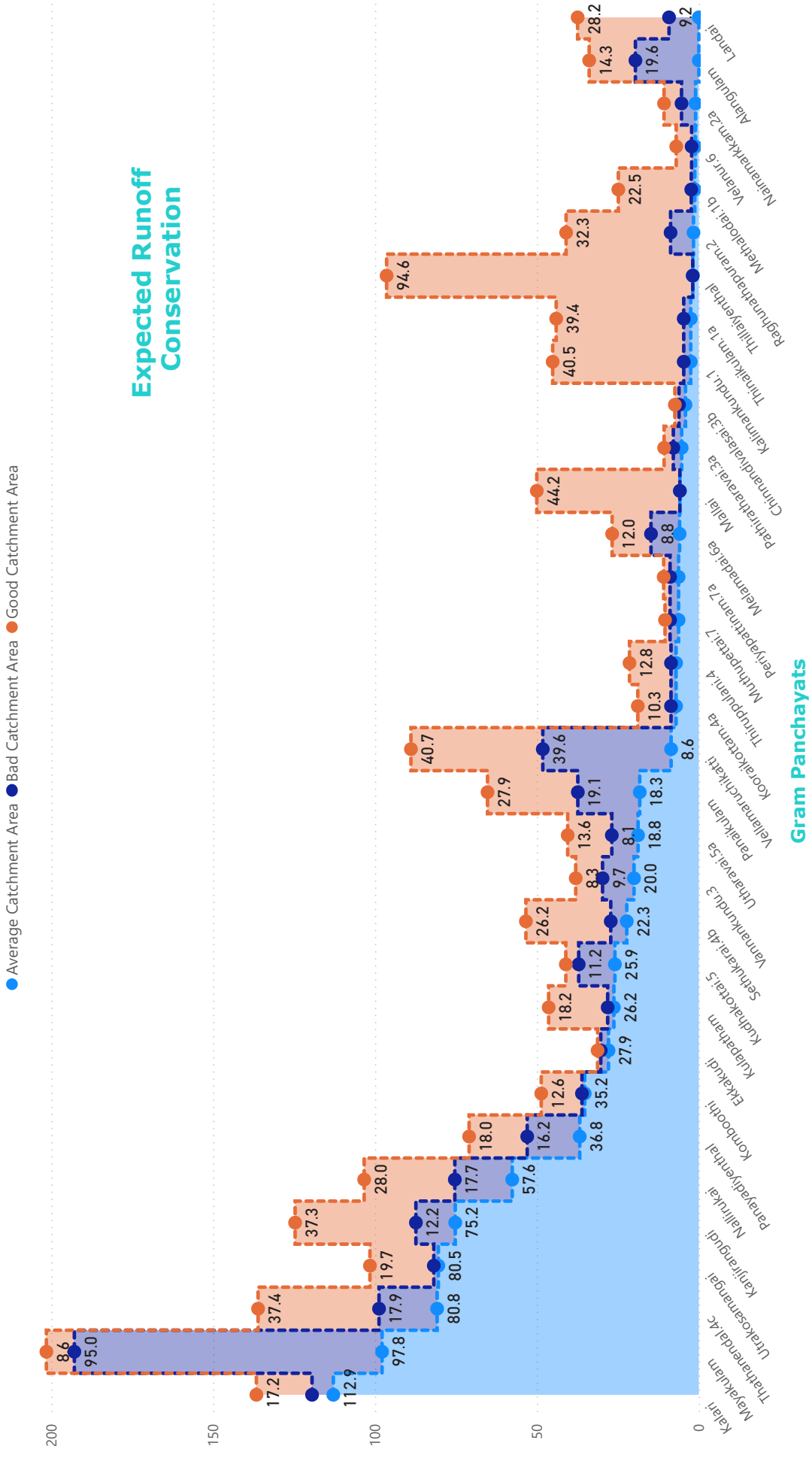


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

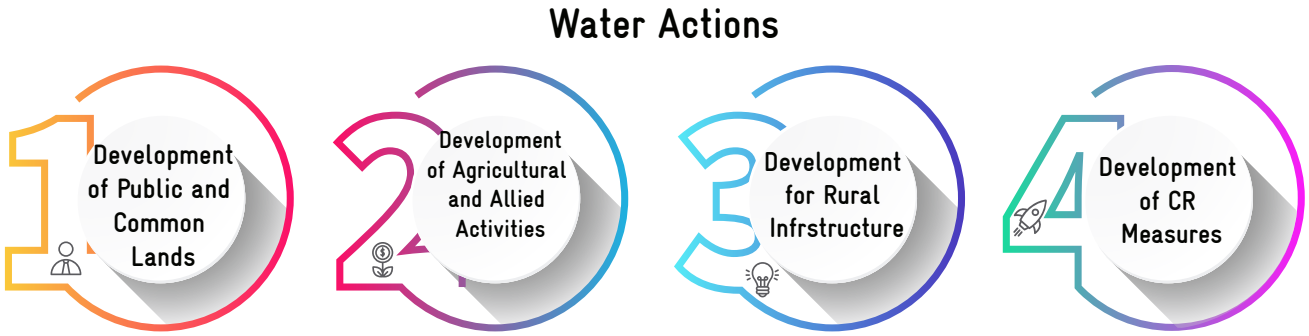
Mahatma Gandhi NREGS Annual circular 2020-21 (Clause 6.3)

Planning and design of works under Mahatma Gandhi NREGS 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.

The key water actions proposed under four categories through Mahatma Gandhi NREGA convergence of considering its models under Right to Plan and Prepare a Shelf of Projects (Clause 6) are



5.2 DEVELOPMENT OF PUBLIC & COMMON LANDS

The effective water augmentation measures are proposed in public and common lands via massive tree plantation, restoration of waterbodies etc., as listed in Table 12 and Figure 5.4.

DEVELOPMENT OF PUBLIC AND COMMON LANDS

TABLE 12. DETAILS OF WORK PROPOSED TO DEVELOP PUBLIC AND COMMON LANDS

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
CONTOUR CONTINOUS BUNDS (CCB) FOR AFFORESTATION AREA(M)	3,809	10	0.025	95.23	38,093
COMPOSTING(NUMBER OF UNITS)	605	15	0.17	102.85	9,075
AFFORESTATION IN PUBLIC/ COMMON LANDS(HA)	952	3,344	8.6	8,187.20	31,83,488
BLOCK PLANTATION (COMMUNITY)(HA)	5,183	4,320	11.1	57,531.30	2,23,90,560
SILVI-PASTURE DEVELOPMENT(HA)	-	6,664	17.1	-	-
LINEAR PLANTATION(KM)	58	703	1.8	103.55	40,440.1
CANAL BUND PLANTATION(HA)	93	2,930	7.5	698.48	2,72,870.9
IRRIGATION CHANNEL PLANTATION (M)	8,950	6	0.015	134.25	53,700
AVENUE PLANTATION(KM)	133	703	1.8	239.55	93,555.9
NURSERY DEVELOPMENT (NUMBER OF UNITS)	986	2,344	15	14,783.25	23,10,129.2
RESTOTARATION OF WATER BODIES: A) PWD AND TANKS (NUMBER)	62	800	5	310	49,600
RESTORATION OF WATER BODIES: B.OORANIS (NUMBER)	361	200	2	722	72,200
RESTORATION OF WATER BODIES: C) PONDS (NUMBER)	-	200	1	-	-
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	1,164	391	2.5	2,910	4,55,124
WATER COURSE - IRRIGATION CHANNELS - DESILTING (MTRS)	8,950	3	0.0075	67.13	26,850
DRAINAGE LINE TREATMENT (M)	1,406	5	0.03	42.19	7,031.5
TOTAL	32,712			85,926.96	2,90,02,717.6

COASTAL WATERSHED WORKS

NURSERY DEVELOPMENT - COASTAL PLANTATION (NUMBER OF UNITS)	4	7,813	20	79	30,863
MANGROVE PLANTATIONS (HA)	-	6,250	16	-	-
RIVERSIDE PLANTATION (HA)	-	703	1.8	-	-
COASTLINE SHELTER BELT PLANTATION (HA)	-	2,930	7.5	-	-
BUND PLANTATION WET LANDS (KM)	3,676	2,930	0.2	689.3	1,07,70,973
WETLAND PLANTATION (INNER) (HA)	42	2,930	7.5	315.6	1,23,309.1
COASTAL WETLAND - BUND STRENGTHENING (KM)	7,654	977	0.1	478.4	74,78,153.4
WETLAND INLET IMPROVEMENT WORKS (NUMBER OF UNITS)	928	3,906	10	9,280	36,24,768
CHECK DAM FOR CONTROLLING SEA WATER INTRUSION (NUMBER OF UNITS)	12	234	1.5	18	2,808
CONSTRUCTION OF FISH DRYING YARD (NUMBER OF UNITS)	2	331	2.1	4.2	662
AGRO FORESTRY IN INDIVIDUAL LANDS (HA)	494	2,930	7.5	3,705	14,47,420
TOTAL	12,812			14,569.54	2,34,78,957

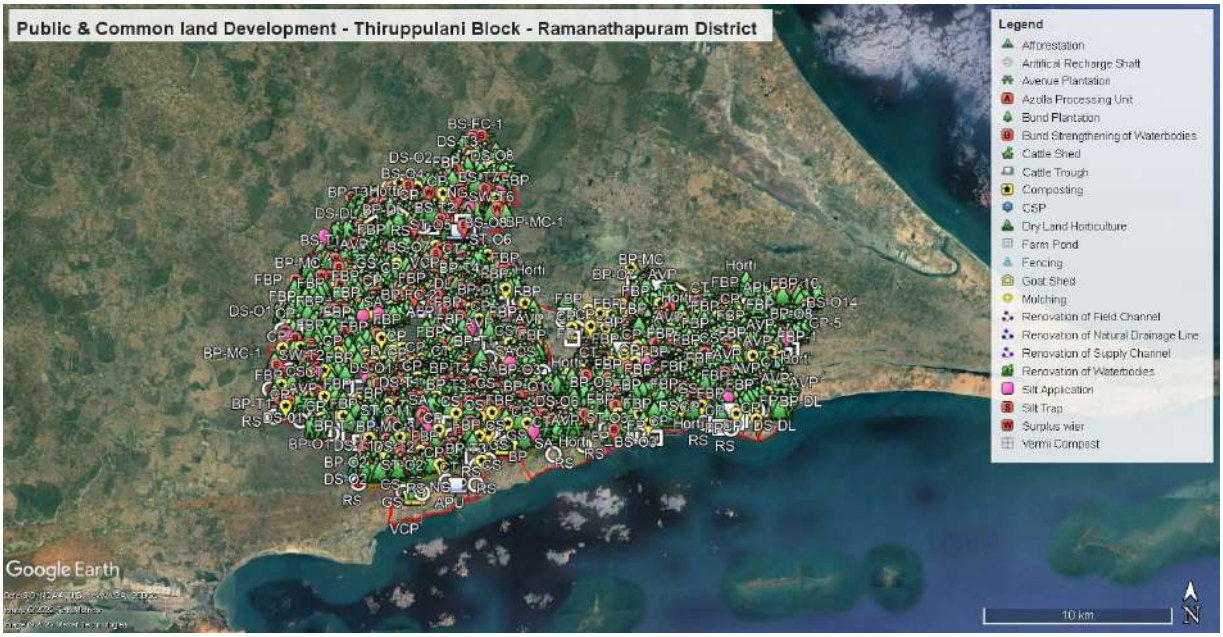


Figure 5.4. Proposed development activities in public and common land

5.3 DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

Based on the assessment, the works which enhance the agriculture and allied sectors particularly for irrigation, soil and live stocks are proposed in the lands under individual ownership (Table 13 & Figure 5.5).

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

TABLE 13. DETAILS OF WORKS PROPOSED TO DEVELOP AGRICULTURE AND ALLIED SECTORS

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
FARM BUNDING WITH BOUNDARY TRENCHES - INDIVIDUAL (ha)	2,660	586	1.5	3,990	15,58,760
MICRO IRRIGATION (ha)	462	-	1	462	-
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	605	781	2	1,210	4,72,505
LAND DEVELOPMENT - INDIVIDUAL (ha)	755	3,906	10	7,550	29,49,030
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	1,330	3,321	8.5	11,305	44,16,930
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	162	23	0.15	24.30	3,726
NADEP VERMI-COMPOST (NUMBER OF UNITS)	162	27	0.18	29.16	4,374
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	162	2,344	1.48	239.76	3,79,728
CATTLE SHELTERS (NUMBER OF UNITS)	162	331	2.12	343.44	53,622
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	1,483	355	2.27	3,366.41	5,26,465
CATTLE TROUGH (NUMBER OF UNITS)	162	6	0.5	8.10	972
POULTRY SHED (NUMBER OF UNITS)	384	10	0.09	34.56	3,840
TOTAL	8,489			28,562.73	1,03,69,952

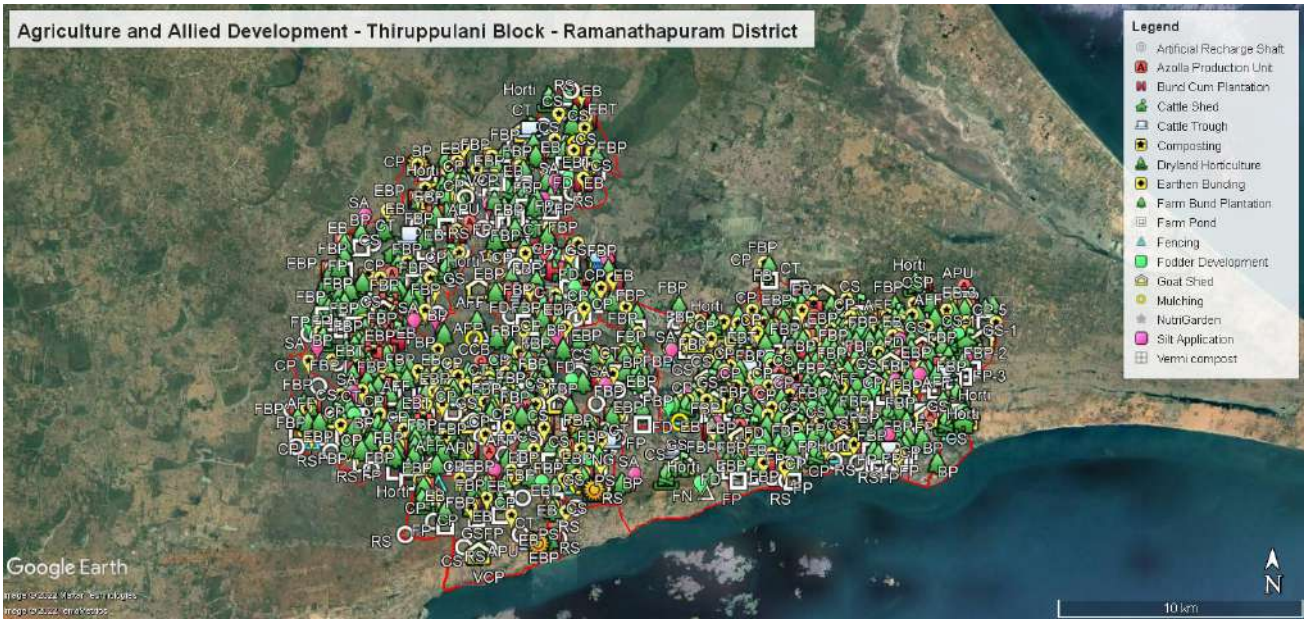


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.4 DEVELOPMENT OF RURAL INFRASTRUCTURE

The prominent works on constructing structures for water harvesting and grey water management are proposed as in Table 14 and Figure 5.6.

DEVELOPMENT OF RURAL INFRASTRUCTURE

TABLE 14. DETAILS OF WORK PROPOSED TO DEVELOP RURAL INFRASTRUCTURE

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
SOAK PITS (COMMUNITY) (NUMBER OF UNITS)	391	20	0.13	50.83	7,820
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	3,946	16	0.1	394.60	63,136
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	66	625	4	264	41,250
TANKA - COMMUNITY LEVEL (NO. OF UNITS)	0	300	30	0	0
TOTAL	4,403			709	1,12,206

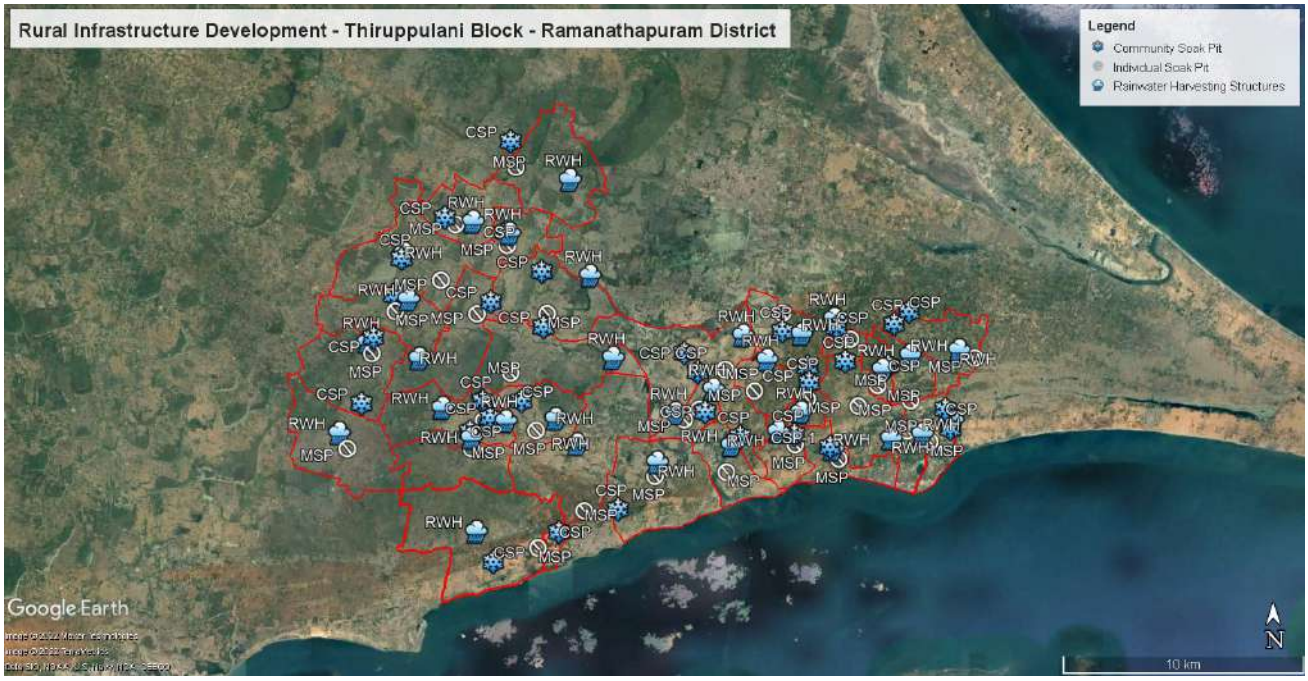


Figure 5.6. Proposed rural infrastructure activities

5.5 PROPOSED CLIMATE RESILIENCE MEASURES

Climate resilient measures are proposed to enable the system to cope up with future climate risks such as droughts, heatwaves and floods (Figure 5.7). Proposed CRM includes public, agriculture and rural infrastructure activities, whereas focus is given on public and common land development measures followed by agriculture and allied development. Measures such as farm ponds (Table 16), coastal shelter belt plantation (Table 17), horticulture park (Table 18), mega forest plantation (Table 19), Avenue plantation (Table 20), mini forest (Table 21) and Tanka (Table 22) were proposed in this Block in saturation mode. Among the activities mini forest works are more in number (76) followed by tanka (31) while avenue plantation, shelter belt are less as one.

TABLE 15. GP WISE PROPOSED CRM3

GP	Public and common land	Agriculture and allied activities	Rural infrastructures
Alankulam	Mini forest	Nursery development	Tanka
Chinnandivalasai		Nursery development	Tanka
Ekkakudi	Mega forest	Nursery development	Tanka
	Mini forest		
Kalari	Mini forest	Nursery development	Tanka
Kalimankundu	Coastal shelter belt plantation	Nursery development	Tanka
	Mini forest		
Kanjirangudi	Mini forest	Nursery development	Tanka
	Mega forest		
Kompoothi	Mini forest	Nursery development	Tanka
Koraikootam	Mini forest	Nursery development	Tanka
Kulapatham	Mini forest	Nursery development	Tanka
Kuthakkottai	Mega forest	Nursery development	Tanka
	Mini forest		
Landai	Mini forest	Nursery development	Tanka

Mallal	Mega forest	Nursery development	Tanka
Mayakulam	Mega forest	Nursery development	Tanka
Melamadai	Mini forest	Nursery development	Tanka
Methalodai	Mini forest	Nursery development	Tanka
Muthupettai	Mini forest	Nursery development	
Nainamaraikkan	Mega forest	Nursery development	Tanka
	Mini forest		
Nallirukkai	Mini forest	Nursery development	Tanka
Panaikkulam	Mega forest	Nursery development	Tanka
	Mini forest		
Panaiyadiyendal	Mini forest	Nursery development	Tanka
Pathiratharavai	Mini forest	Nursery development	Tanka
Periyapattinam	Mini forest	Nursery development	
Regunathapuram	Mega forest	Nursery development	Tanka
	Mini forest		
Sethukkarai	Mini forest	Nursery development	Tanka
Thathanenthal	Mini forest	Horticulture parks	Tanka
	Mega forest	Nursery development	
	Avenue plantation		
Thillaiyendal	Mini forest	Nursery development	Tanka
Thinaikkulam		Nursery development	Tanka
Uthrakosamangai	Mini forest	Nursery development	Tanka
Thiruppulani	Mini forest	Farm pond	Tanka
		Nursery development	
Utharavai	Mini forest	Nursery development	Tanka
Vannankundu	Mini forest	Nursery development	Tanka
Velanoor	Mini forest	Nursery development	Tanka
Vellamarichikkatti	Mini forest	Nursery development	Tanka

TABLE 16. DETAILS OF PROPOSED FARM PONDS ACTIVITY UNDER CRM

Block Target	Community Farm Ponds	Community Farm Ponds Completed	Individual Farm Ponds	Individual Farm Ponds Com-pleted	Individual Farm Ponds Ongoing
142	127	127	15	13	2

TABLE 17. DETAILS OF PROPOSED COASTAL SHELTER BELT PLANTATION ACTIVITIES UNDER CRM

GP	Length in Km	Land type
Kalimangundu	2.00	Forest Land

TABLE 18. DETAILS OF PROPOSED HORTICULTURE PARK ACTIVITIES UNDER CRM

GP	Survey Number	Area in ha	No. of Plants (1 ha - 10000 saplings)	Land type
Thathanendhal	123	2.00	3000	Govt. purampokku land

TABLE 19. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

GP	Area in ha	No. of Plants	MGNREGS Amount in Lakhs			Man-days	Land type
			Labour (L)	Materials (M)	Total (L+M)		
Ekkakudi	0.5	5,000	15,03,230	6,770	15,10,000	5,871	Govt. Purampokku land
Kanjirankudi	0.5	5,000	15,03,230	6,770	15,10,000	5,871	
Kuthakottai	0.5	5,000	14,67,371	4,629	14,72,000	5,731	
Mallal	1	10,000	24,65,015	11,832	2,47,66,847	9,487	
Mayakulam	0.5	5,000	15,03,230	6,770	15,10,000	5,871	
Nainamaraikan	0.5	5,000	15,03,230	6,770	5,10,000	5,871	
Panaikkulam	0.5	5,000	15,03,230	6,770	15,10,000	5,871	
Regunathapu-ram	0.5	5,000	15,03,230	6,770	15,10,000	5,871	
Thathanenthal	1	10,000	9,34,742	13,258	29,48,000	11,462	
Total	**5.5**	**55,000**	**1,58,86,508**	**70,339**	**3,82,46,847**	**61,906**	

TABLE 20. DETAILS OF PROPOSED AVENUE PLANTATION ACTIVITY UNDER CRM

GP	Road Length (in Km)	Area of plantation (in ha)		No. of Plants	Classification of Land
		No. of Big Trees	No. of Small Trees		
Thathanenthal	3.18	318	636	954	Govt Purampokku land

TABLE 21. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area in ha	No. of Plants	MGNREGS Amount in Lakhs			Man-days	Land type
			Amount in Lakhs	Materials (M)	Total (L+M)		
Alankulam	0.05	500	1,46,737	9,623	1,62,500	643	Govt. Purampokku land
Ekkakudi	0.05	500	1,46,737	9,623	1,62,500	643	
Kalari	0.15	1,500	4,40,211	28,869	4,87,500	1,929	
Kalimangundu	0.20	2,000	5,86,948	38,492	6,50,000	2,572	
Kanjirangudi	0.15	1,500	4,40,211	28,869	4,87,500	1,929	
Kompoothi	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Koraikoottam	0.05	500	1,46,737	9,623	1,62,500	643	
Kulapatham	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Kuthakottai	0.25	2,500	7,33,685	48,115	8,12,500	3,215	
Landhai	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Mallal	0.10	1,000	2,93,474	19,246	3,25,000	1,286	

Mayakulam	0.15	1,500	4,40,211	28,869	4,87,500	1,929	Govt. Purampokku land
Melamadai	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Methaloadai	0.05	500	1,46,737	9,623	1,62,500	643	
Muthupettai	0.05	500	1,46,737	9,623	1,62,500	643	
Nainamaraikkaan	0.20	2,000	5,86,948	38,492	6,50,000	2,572	
Nallirukkai	0.05	500	1,46,737	9,623	1,62,500	643	
Panaikkulam	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Panaiyadiyendhal	0.15	1,500	4,40,211	28,869	4,87,500	1,929	
Pathiratharavai	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Periyapattinam	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Regunathapuram	0.20	2,000	5,86,948	38,492	6,50,000	2,572	
Sethukkarai	0.15	1,500	4,40,211	28,869	4,87,500	1,929	
Thathanendhal	0.15	1,500	4,40,211	28,869	4,87,500	1,929	
Thillaiyendhal	0.25	2,500	7,33,685	48,115	8,12,500	3,215	
Thiru uthrakosa-mangai	0.10	1,000	2,93,474	19,246	3,25,000	1,286	
Thiruppulani	0.05	500	1,46,737	9,623	1,62,500	643	
Utharavai	0.15	1,500	4,40,211	28,869	4,87,500	1,929	
Vannangundu	0.20	2,000	5,86,948	38,492	6,50,000	2,572	
Velanoor	0.05	500	1,46,737	9,623	1,62,500	643	
Vellamaruchukkatti	0.15	1,500	4,40,211	28,869	4,87,500	1,929	

TABLE 22. DETAILS OF PROPOSED TANKAS ACTIVITY UNDER CRM

GP	GP	GP	GP
Alankulam	Kulapatham	Nallirukkai	Thinaikkulam
Chinnandivalasai	Kuthakkottai	Panaikkulam	Thiru_uthra_kosamangai
Ekkakudi	Landai	Panaiyadiyendal	Thiruppullani
Kalari	Mallal	**Pathiratharavai**	Utharavai
Kalimankundu	Mayakulam	Regunathapuram	Vannankundu
Kanjirangudi	Melamadai	Sethukkarai	Velanoor
Kompoothi	Methalodai	Thathanenthal	Vellamarichikkatti
Koraikootam	Nainamaraikkan	Thillaiyendal	

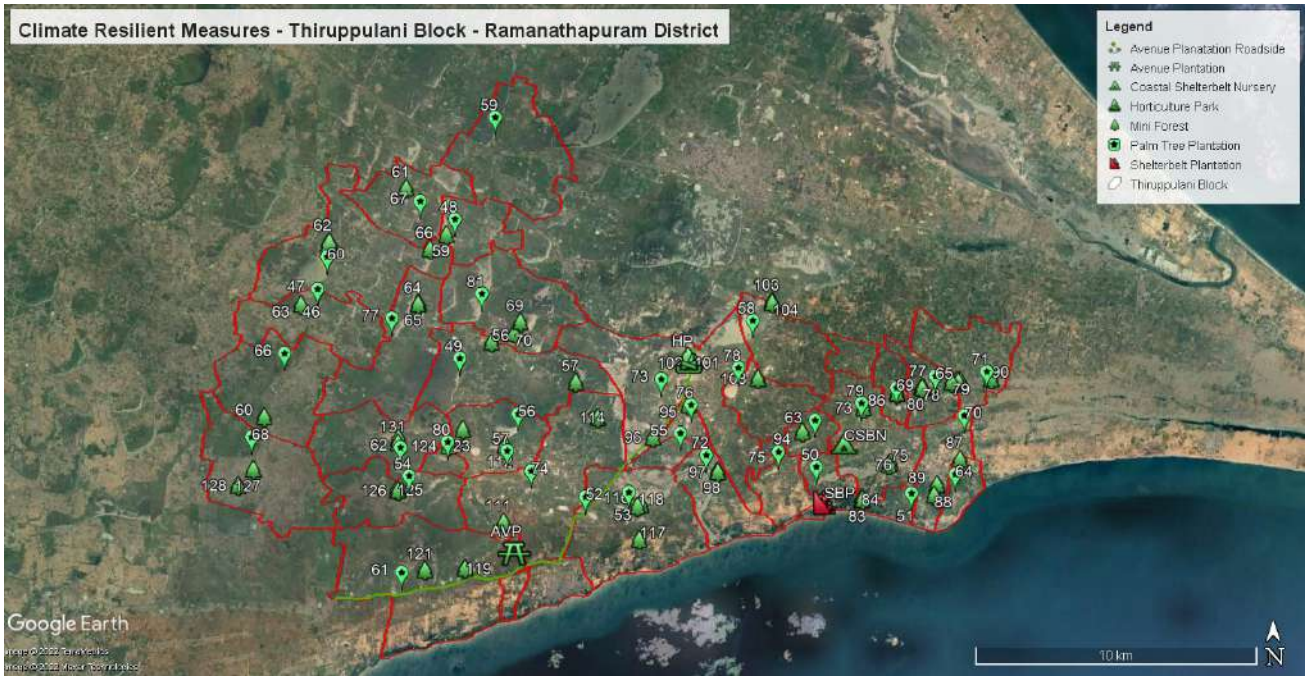


Figure 5.7. Proposed climate resilient measures

நெடுங்கடலும் தன்நீர்மை குன்றும் தடிந்தெழிலி
தான்நல்கா தாகி விடின்

குறள் - 17

The ocean's wealth will waste away
Except the cloud its stores repay

Thirukkural - 17

CHAPTER 6

PROJECTED OUTCOMES OF PLANNING IN THIRUPPULLANI BLOCK

6 PROJECTED OUTCOMES OF THREE YEAR PERSPECTIVE PLAN

In view of Mahatma Gandhi NREGS guidelines, Key Water Actions are proposed based on climate vulnerability assessment and challenges at GP level for three years period from 2021- 2022 to 2023-2024. At the end of the implementation period during 2024, the following productive outcomes are envisaged on successful accomplishment of all proposed Key Water Actions. The anticipated outcome will reduce the water security vulnerability and increase the resilience of the GPs under current and projected climatic change scenarios.

6.1 OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

	INDICATOR		OUTCOMES/ IMPACT
1	Proportion of Land development under WASCA treatment	1	8,795 ha (31 %) of the total area treated under WASCA
2	Percentage reduction of run off	2	1,825 ha.m i.e 41 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	3	423 waterbodies (tanks/pond and ooranis) restored
4	Area under afforestation	4	952 ha area under afforestation
5	Length of drainage line treated	5	56 Km length of drainage line treated
6	Canal Bund Plantation	6	More than 18 thousands plants through 93 works
7	Nursery development	7	986 units

8,795 ha AREA TREATED

1,825 ha.m TOTAL RUNOFF HARVESTED

423 WATER BODIES RESTORED

952 ha AREA AFFORESTATION

18,000 PLANTS

986 NURSERY UNITS

56 Km DRAINAGE LINE TREATED

COASTAL WATERSHED WORKS

	INDICATOR		OUTCOMES/ IMPACT
1	Check dam	1	12 check dams for controlling sea water intrusion
2	Bund plantation in west land	2	12,703 plants
3	Agroforestry in coastal area	3	494 ha

12 CHECK DAMS

12,703 PLANTS

494 ha AGROFORESTRY

6.2 OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR	OUTCOMES/ IMPACT
1	Assessment of sources of water for livestock and agriculture demand No of structures established for on-farm *(in-situ)* water harvesting in dry lands	605 farm ponds established which target the harvest of 106 ha.m of water which has the potential to irrigate 213 ha area in both kharif and rabi seasons
2	Improvement in soil health	162 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	1,330 ha under dry land horticulture
4	Households established fodder plots	162 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	2,029

605 FARM PONDS

162 COMPOST UNITS

1,330 ha DRY LAND HORTICULTURE

162 FODDER PLOTS

2,029 LIVESTOCK'S SHEDS

6.3 OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

	INDICATOR	OUTCOMES/ IMPACT
1	No. of GPs having liquid waste management systems	3,946 individual and 391 community level soak pits established for recycle of grey water benefiting 36,945 HHs
2	Roof rain water harvesting measures	66 common roof rainwater harvesting and storage structures with a target to harvest and store 0.1 ha.m of rainwater for use
3	Nutri-garden	36,945 HHs established nutri-gardens in homesteads and planted 1,84,725 saplings

391 COMMON & **3,946** INDIVIDUAL SOAK PITS

66 COMMON ROOF RAINWATER HARVESTING

36,945 NUTRI-GARDENS

1,84,725 SAPLINGS

6.4 OUTCOMES OF CLIMATE RESILIENCE MEASURES

OUTCOMES OF CLIMATE RESILIENCE MEASURES

	INDICATOR		OUTCOMES/ IMPACT
1	Vulnerable GPs are identified for key water actions	1	All GPs (34) are vulnerable for drought, heat-waves vulnerability
2	Climate resilient measures are identified for climate risks	1	7 models are identified via., Farm ponds, coastal shelter belt plantation, horticulture park, avenue plantation, mini forest, mega forest, and tankas 82 farm ponds in 28 GPs 2 Km of costal shelter belt plantation Horticulture park in 2 ha. Mega forest in 5.5 ha area with 55,000 plants Avenue plantation along the road of length 3.18 Km with 954 tress Mini forest in 3.8 ha with 38,000 plants Tankas in 31 GPs

82 FARM PONDS

2 Km COSTAL SHELTER BELT PLANTATION

2 ha HORTICULTURE PARK

5.5 ha MEGA FOREST

3.18 KM AVENUE PLANTATION

3.8 ha MINI FOREST

31 TANKAS

Estimated person days

The total estimated person days required for the above propose activities are 6,29,63,883 as specified below Figure 6.1

Estimated Cost

The total estimated cost budgeted for the above propose activities is Rs 1,29,769 Lakhs as specified below in Figure 6.2

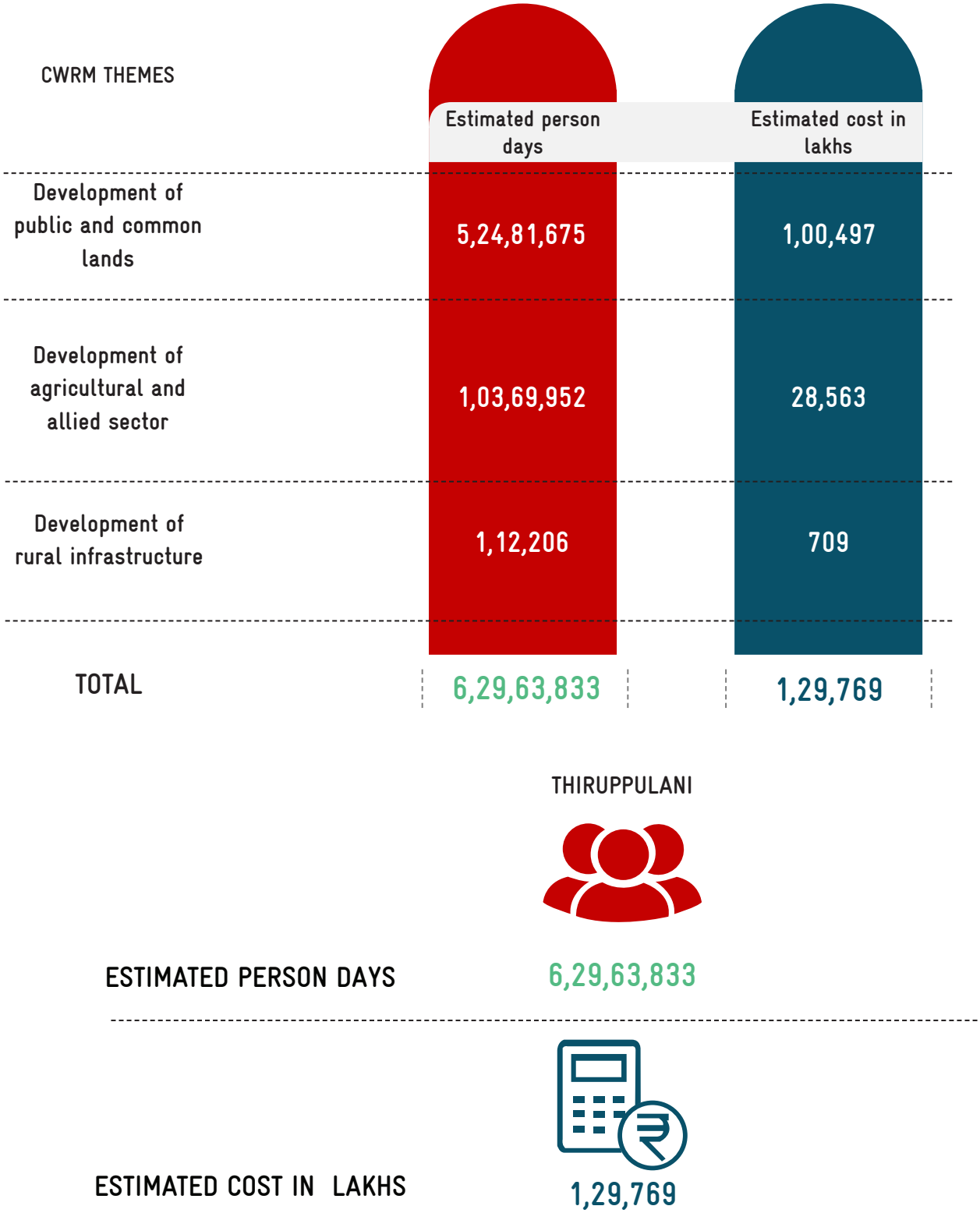


Figure 6.1 & 6.2 Estimated person days & cost for all water actions

6.5 LINKAGES TO SDGS, NDCS

The 2030 Agenda and the Paris Agreement put forth an innovative and complementary framework for accelerating action and achieving ambitious sustainable development objectives. Under the 2030 Agenda, a series of 17 global Sustainable Development Goals (SDGs) have been agreed that are to be universally achieved. Under the Paris Agreement, countries are committed to reduce greenhouse gas emissions through Nationally Determined Contributions (NDC) in order to strengthen resilience to climate change. Both The SDGs and Paris Agreements demands urgent climate action and linking WASCA activities with these two agendas is indispensable.

6.5.1 NATIONALLY DETERMINED CONTRIBUTION GOALS AND WASCA TN'S PROGRESS THROUGH NDC

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 ◦ 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 NDCs that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national economies has been increasingly recognized in most Nationally Determined Contributions (NDCs). Many parties included measures related to flooding and drought and chose to include qualitative information on the likely effect of climate change on key sectors.

India's NDC

India's NDC emphasis Sustainable Development, Climate Justice, and Lifestyles

Activities

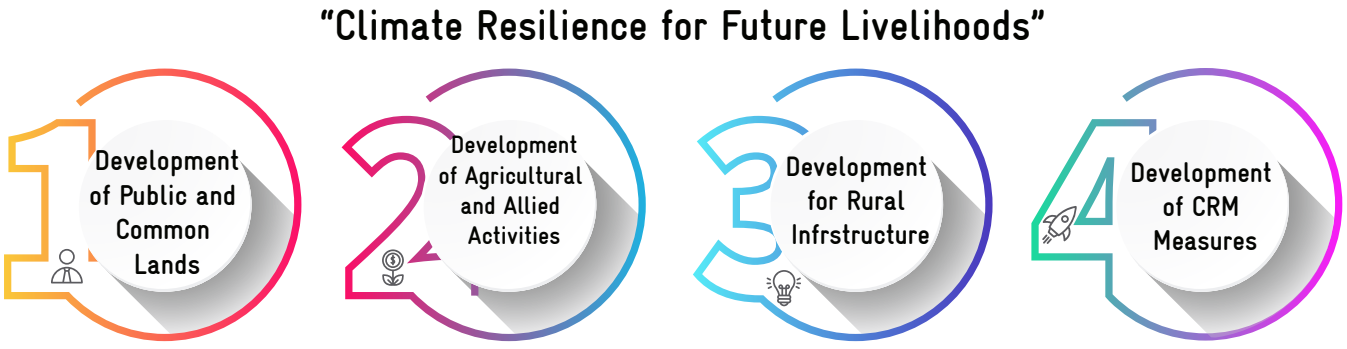
Activities includes Adaptation, Mitigation, requirement for Finance, Technology transfer, Capacity Building

WASCA TN marching on the road to support India's NDC vision by,

1. Supporting creation of an additional carbon sink of 2.5–3 billion tonnes through additional forest and tree cover
2. Enhancing investments in development programs for climate change adaptation in vulnerable sectors
3. Implementing programs to achieve the sustainable natural resource management and efficient utilization of natural resources, leading to a reduction in the "ecosystem footprint"
4. Providing qualitative information on the likely effect of climate risks on key sectors via, water, agriculture and allied sector and socio economic

6.5.2 WASCA TN SUPPORTS SDG

WASCA – TN's four major actions for making "Climate Resilience for Future Livelihoods" are envisaged through SDGs.



TN WASCA will achieve the above actions working closely with Mahatma Gandhi NREGA programme of Ministry of Rural Development and National Water Mission programme of (MoJS). These two ministries are the key stakeholders for WASCA. Apart from these two ministries, the works under WASCA TN are closely linked with Ministry of Agriculture and MoEFCC. The commitments of the above mentioned four ministries towards SDG goals achievements are mapped in connection with the interventions under WASCA Tamil Nadu. The intervention under WASCA TN has direct and indirect contribution to the SDGs and its national targets set as per NITI Aayog.

6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.A, 6.B

SDG GOAL 6

SDG 6 by 2030 : Ensure availability and sustainable management of water and sanitation for all

6.1	Achieve universal and equitable access to safe and affordable drinking water for all
6.2	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	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	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	Implement integrated water resources management at all levels (6.5.1)
6.6	Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.A	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

Indicators considered for district and Block level vulnerability assessment of WASCA TN which is also used in SDG India 2020-21 report (Table 23)

TABLE 23. COMMON VULNERABILITY INDICATORS USED IN WASCA TN & SDG INDIA 2020-21

Head count ratio as per the Multidimensional Poverty Index	
	Persons provided employment as a percentage of persons who demanded employment under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

Percentage of rural population getting safe and adequate drinking water within premises through Piped Water Supply

Percentage of rural population having improved source of drinking water

Percentage of ground water withdrawal against availability

Percentage of Blocks/mandals/talukas over-exploited

Percentage of area covered under afforestation schemes to the total geographical area

Percentage of degraded land over total land area

Percentage increase in area of desertification

The indicators used for district level vulnerability assessment along with its linked SDGs are already tabulated in (Table 2). The detailed proposed water actions in CWRM which was assessed based on the vulnerability dimensions are linked with climate vulnerability index and SGDs are tabulated in Table 24 to 26.

TABLE 24. WATER ACTIONS ON DEVELOPMENT OF PUBLIC & COMMON LANDS & ITS LINKED SDG

Name of the work	No. of CWRM works	CVI Impacting (WASCA TN)	Linked SDG Goal
Contour Continuous Bunds for Afforestation area (m)	3,809	W3	SDG 1,2, 6,13&15
Composting (No. of units)	605	W1	SDG1& 6
Afforestation in Public/common lands (ha)	952	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	5,183	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	-	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (Km)	58	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	93	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	8,950	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (Km)	133	C1,C2,C3,W3,S2	SDG 1, 6&13
Nursery Development (No. of units)	986	C1,S2,S4	SDG 1,2 &6

Restoration of waterbodies :PWD and Tanks (No.)	62	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	361	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	-	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	1,164	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	8,950	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	1,406	W1,W3,W4	SDG1 & 6

COASTAL WATERSHEDS WORKS

Name of the work	No. of CWRM works	CVI Impacting (WASCA TN)	Linked SDG Goal
Nursery development -Coastal plantation(No.)	4	C1,S2,S4	SDG 1, 6, 13,
Mangrove plantations(ha)	-	C1,C2,C3,W3,S2	SDG 1, 6, 13, 14, 15
Riverside plantation(ha)	-	W3,S2	SDG 1, 6, 13, 14, 15
Coastline Shelter belt Plantation (ha)	-	W3,S2	SDG 1, 6, 13, 14, 15
Bund Plantation wet lands (Km)	3,676	W3,S2	SDG 1, 6, 13, 14, 15
Wetland plantation (inner)(ha)	42	W3,S2	SDG 1, 6, 13, 14, 15
Coastal wetland - Bund strengthening (Km)	7,654	W3,S2	SDG 1, 6, 13, 14, 15
Wetland Inlet improvement works(No.)	928	W3,S2	SDG 1, 6, 13, 14, 15
Check dam for controlling sea water intrusion (No.)	12	W5	SDG 1, 6, 13, 14, 15
Construction of Fish Drying Yard (No.)	2	S2	SDG 1, 2, 4, 12
Agro Forestry in Individual lands (ha)	494	S2	SDG 1, 2, 6, 13

TABLE 25. WATER ACTIONS ON DEVELOPMENT OF AGRICULTURAL AND ALLIED SECTOR & ITS LINKED SDG

Name of the Work	Number of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	2,660	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	462	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	605	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	755	W1,W5,A1,A3,S2,S4	SDG 2, 6&
15	458	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Dry land Horticulture/Agro-forestry - Individual (ha)	1,330	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	162	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	162	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	162	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	162	S4	SDG 1& 2
Goat/sheep shelters (No. of units)	1,483	S4	SDG 1& 2
Cattle trough(No. of units)	162	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	384	S2,S4	SDG 1& 2

TABLE 26. WATER ACTIONS ON RURAL WATER MANAGEMENT & IT'S LINKED SDG

Name of the work	No. of CWRM works	CVI	Linking SDG
Soak Pits (Community) (No. of units)	391	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	3,946	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	66	W3,S1,S3	SDG 1& 6

சிறப்பொடு பூசனை செல்லாது வானம்
வறக்குமேல் வானோர்க்கும் ஈண்டு

குறள் - 18

The earth beneath a barren sky
Would offerings for the gods deny

Thirukkural - 18

CHAPTER 7

IMPLEMENTATION OF GP PLANS IN THIRUPPULLANI BLOCK

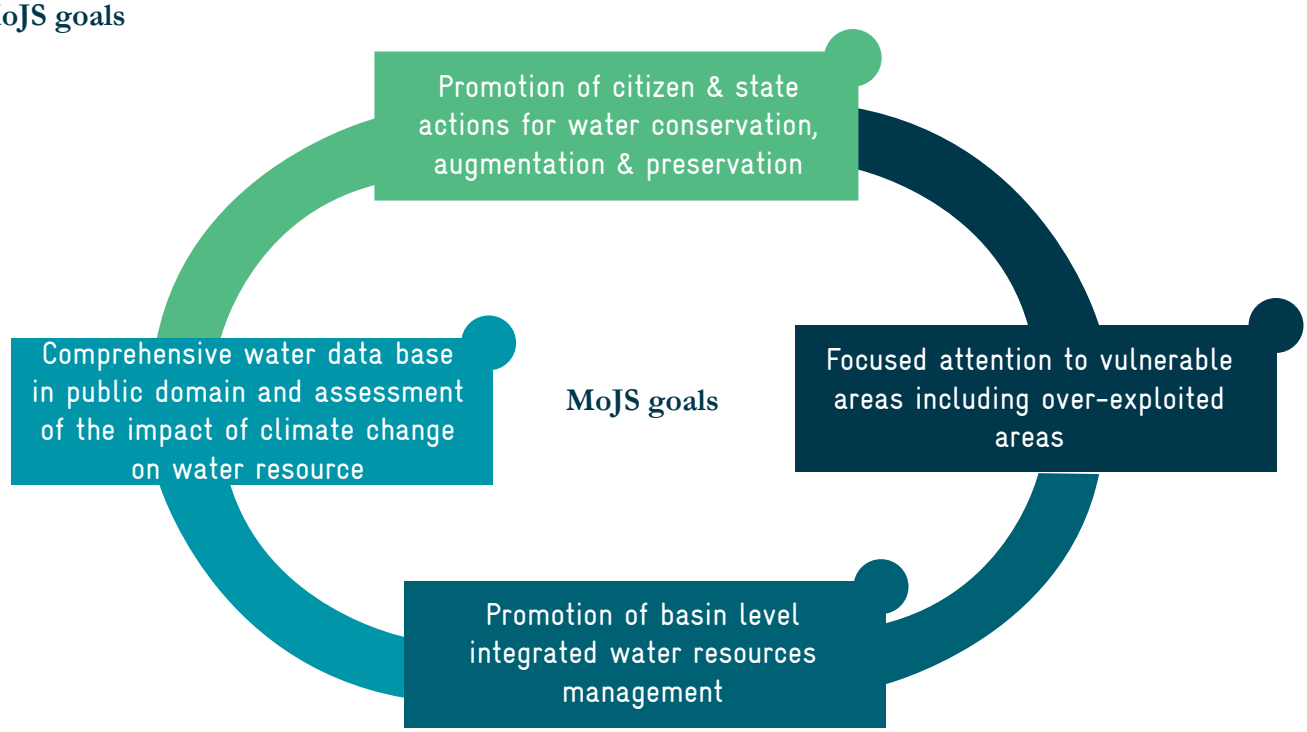
7 IMPLEMENTATION OF GP PLANS

Execution of GP plans includes integrating all verified, approved works in MORD's web enabled ap¬plication NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identi¬fied first, the status of GIS based plans and total works along with its expenditure and category wise esti¬mation cost of works as per GIS Plan, GIS based planning cumulative report are uploaded as given below

7.1 INTEGRATION INTO NREGA SOFT

WASCA is progressing towards digitizing and integrating GP level GIS based plans, both NRM and Non-NRM into Mahatma Gandhi NREGS portal. The performance and implementation of GP plans of Thiruppullani Block is listed in Table 27, work progress and expenditure during the past 3 financial years are shown in Figure 7.1 and 7.2. The Total No. of works, ongoing and completed GIS works are shown in Figure 7.3. The GP wise recommendations and works uploaded are given in Annexure 7.1.

TABLE 27. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN THIRUPPULLANI BLOCK



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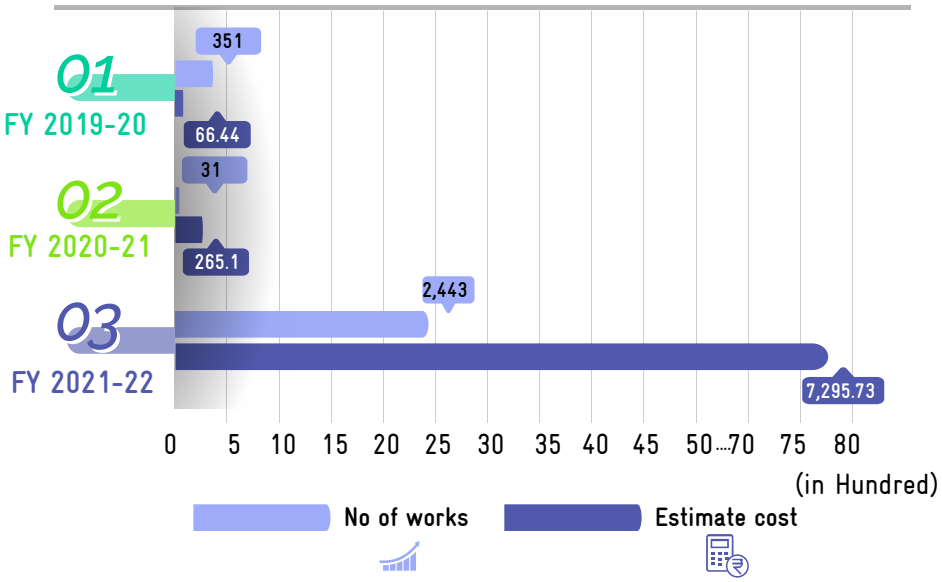


Figure 7.1. Work progress in last 3 years

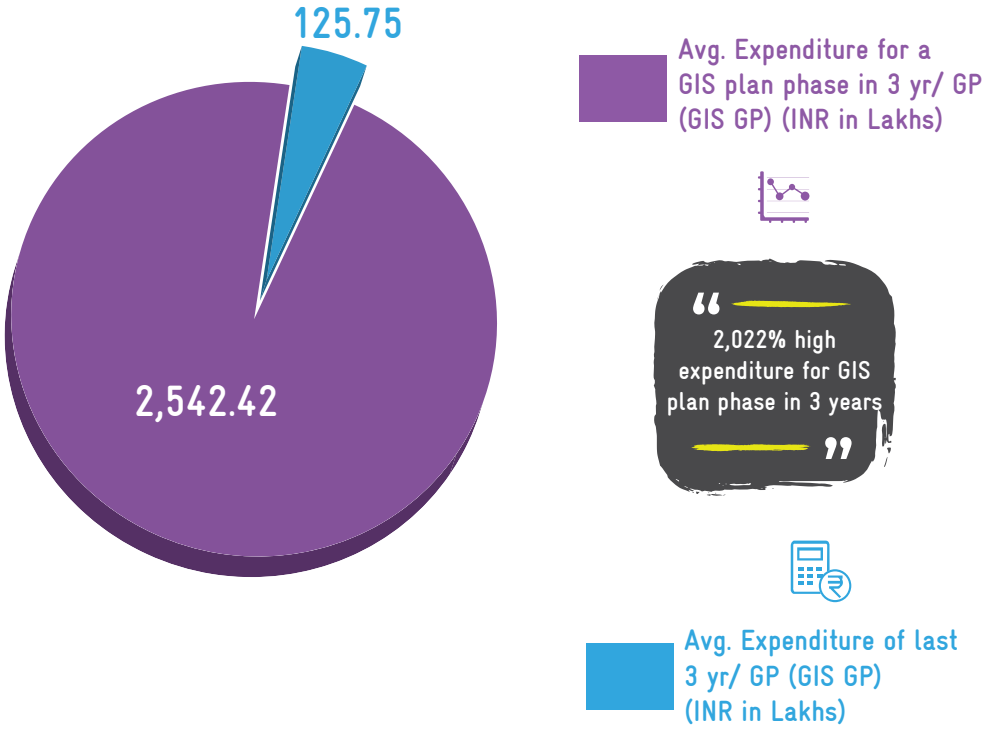
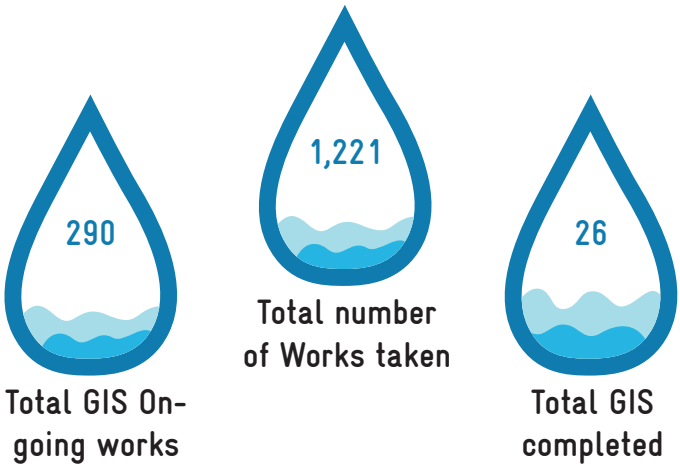


Figure 7.2. Average Expenditure for GIS plan in last 3 years



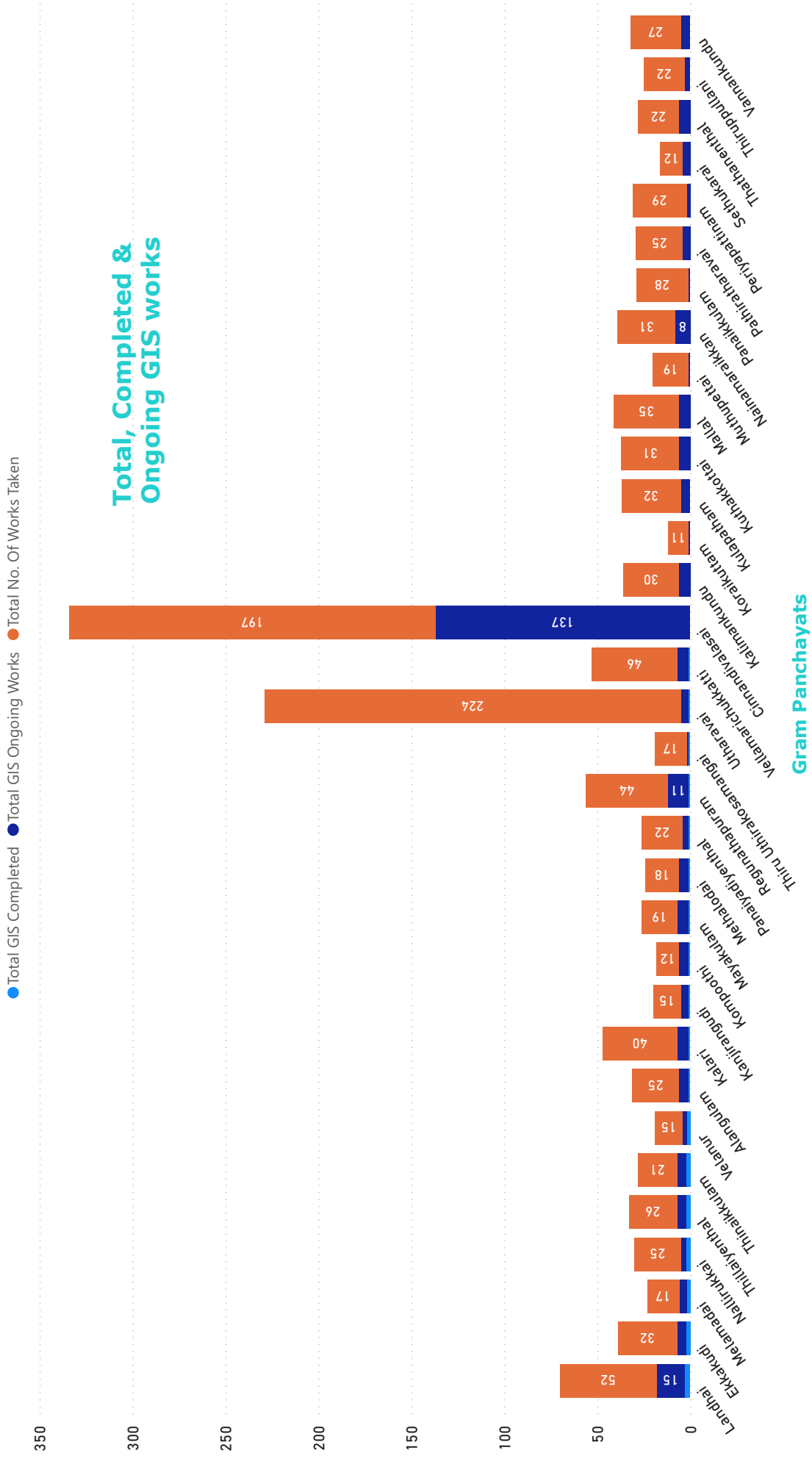
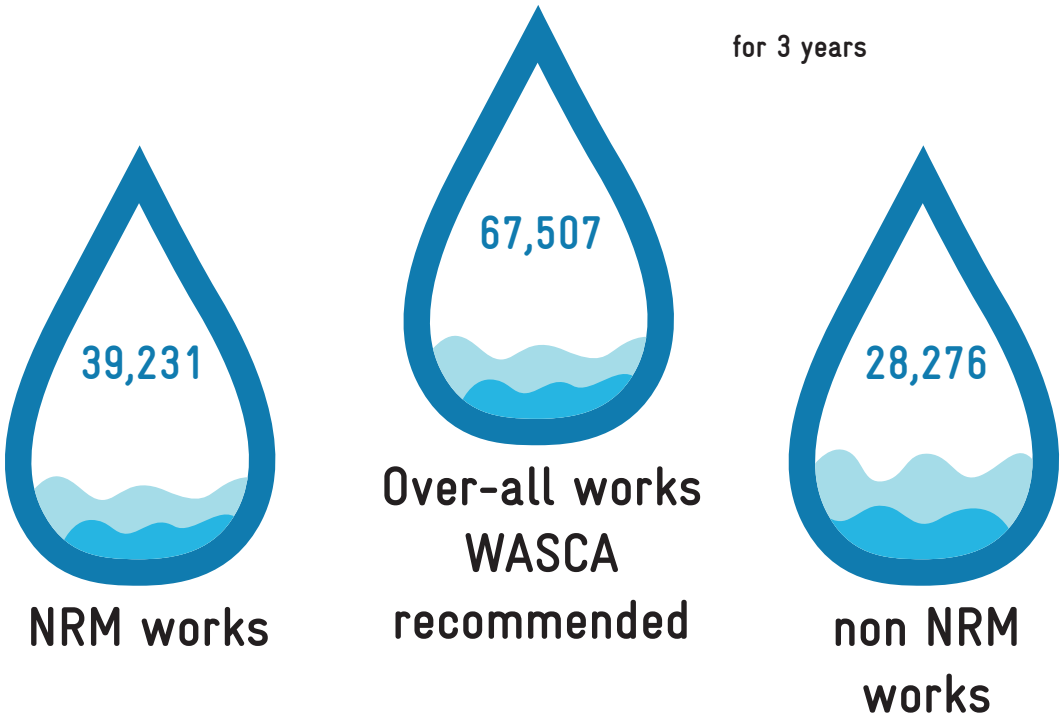


Figure 7.3. GP wise total, completed and ongoing GIS works

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 67,507 works for a period of 3 years, out of which 39,231 are NRM works and 28,276 are non NRM works (Figure 7.4). A total of 95,783 works has been uploaded so far for the financial year 2021-22 as on 18/02/2022.



Check dam Constructed at Thathanenthal rivulet in Thathanenthal panchayat of Thiruppullani block

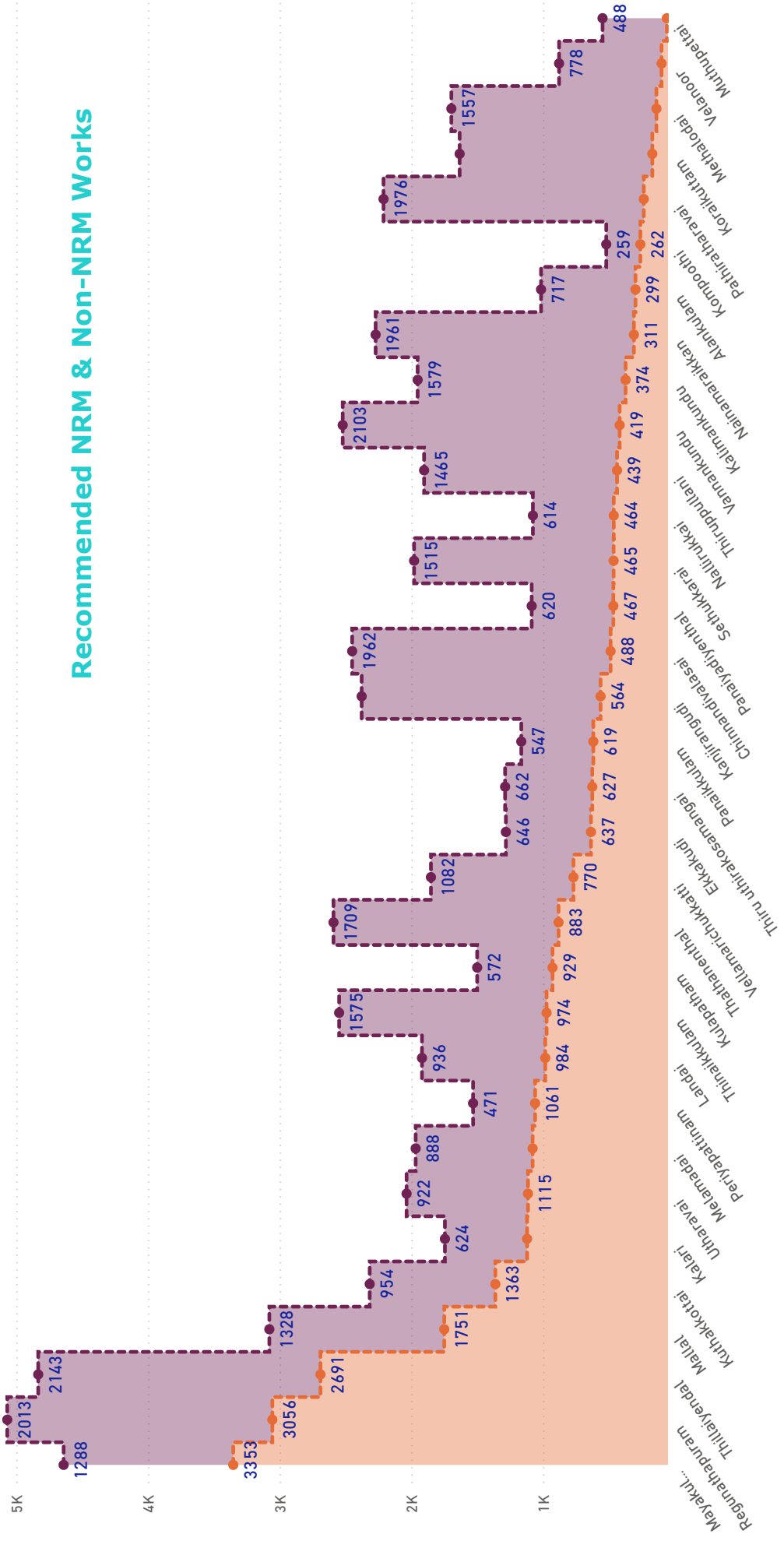


Figure 7.4. GP wise recommended NRM and Non-NMR works

7.3 ONGOING WORKS

The ongoing works in Thiruppulani Block includes Water Conservation and Water Harvesting, Works on Individuals Land (Category IV), Rural Connectivity, and Drought Proofing. A total of 64 works are ongoing in the Block, in which WCWH works are more (72 %) followed by individual beneficiaries works (19 %) while drought proofing less in number (2 %) as shown in Figure 7.5. GP and work category wise ongoing works are tabulated in Annexure 7.2.

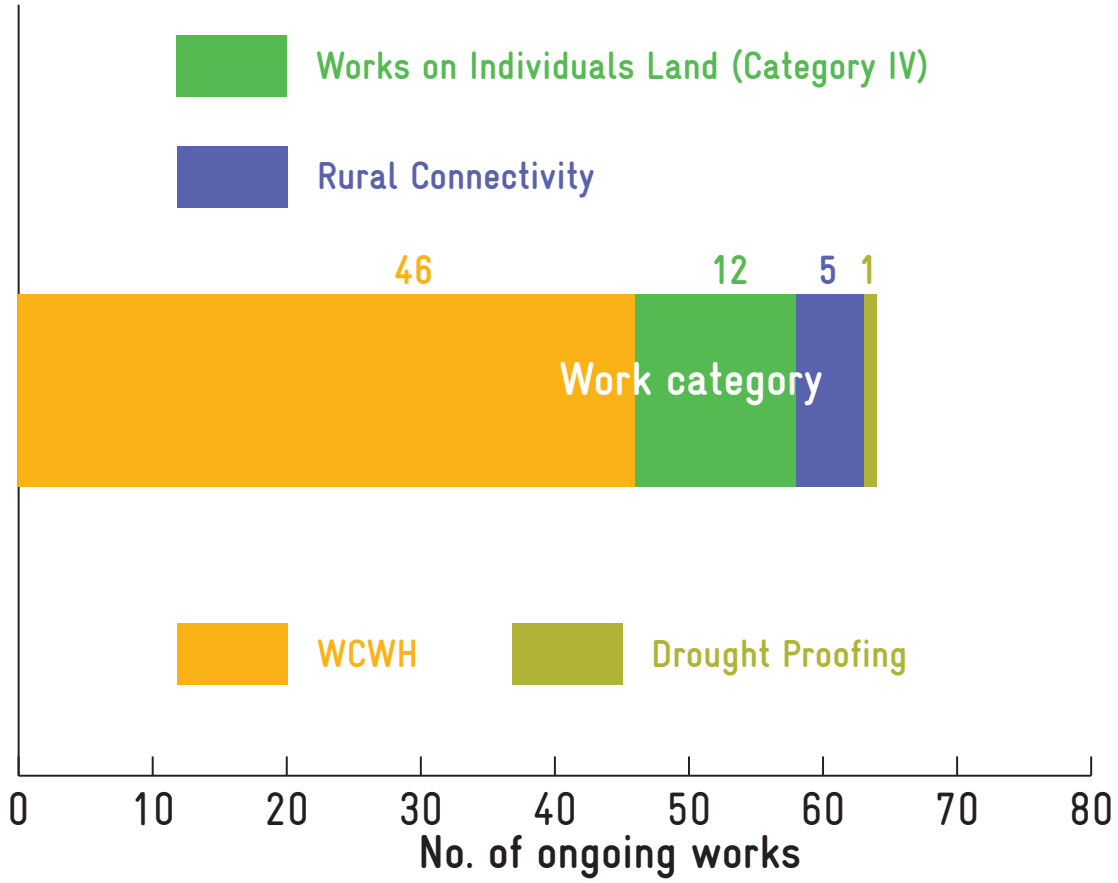


Figure 7.5. Work category-wise ongoing works in Thiruppulani Block

7.4 CATCH THE RAIN

The NWM's campaign "Catch The Rain" with the tag-line "Catch the rain, where it falls, when it falls" is to nudge the states and stakeholders to create appropriate Rain Water Harvesting Structures (RWHS) suitable to the climatic conditions and sub-soil strata before monsoon season. Under this campaign, drives to make check dams, water harvesting pits, rooftop RWHS, removal of encroachments and de-silting of tanks to increase their storage capacity, removal of obstructions in the channels which bring water to them from the catchment areas, repairs to step-wells and using defunct bore wells and unused wells to put water back to aquifers etc., are to be taken up with the active participation of people. The total expenditure towards progressive works on Catch the Rain campaign of Thiruppullani Block is Rs. 1,900.07 Lakhs and nearly 58% of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

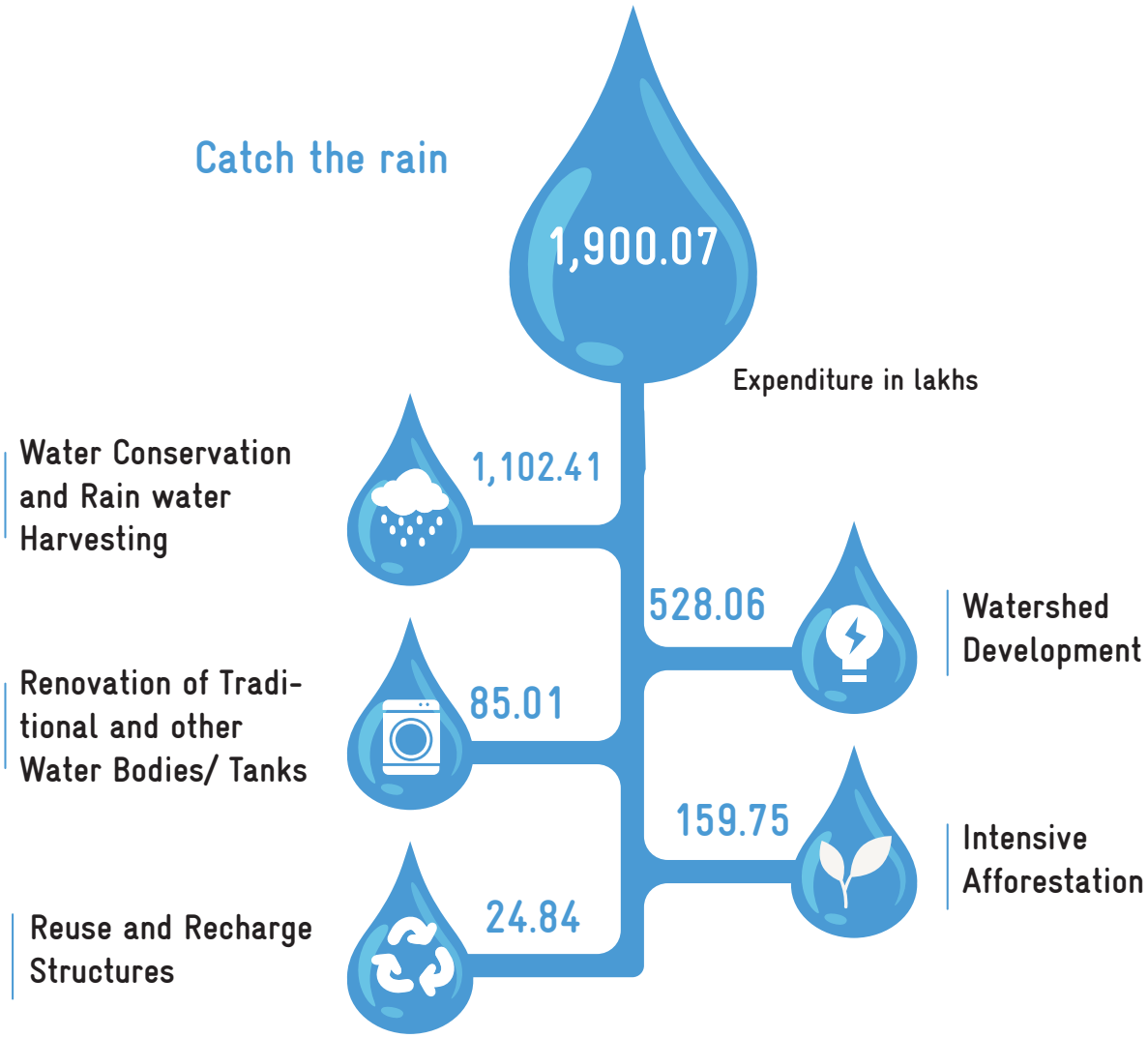


Figure 7.6. Expenditure for Catch the Rain campaign in Thiruppullani Block


Improving existing planning and financial mechanism
WASCA
Developing Climate Resilient Water Measures

தானம் தவம்இரண்டும் தங்கா வியன்உலகம்
வானம் வழங்கா தெனின்

குறள் - 19

Were heaven above to fail below
Nor alms nor penance earth would show

Thirukkural - 19

CHAPTER 8

8 CASE STUDY

This chapter illustrates how CWRM planning processes unfolds the analysis, results and impacts from macro-watershed to the lowest planning unit, the GP through case studies. Case studies explain the need for an integrated multi-tier approach to address the issues of water conservation seen through the lens of climate change. Case studies on micro-watersheds and GP are expounded holistically through macro-watersheds to warrant long-term benefits. This integrated approach will help in watershed assessment, management and monitoring of implementation projects efficiently.

8.1 MACRO-WATERSHEDS OF THIRUPPULANI BLOCK

Thiruppulani Block has two river sub-basins namely 'Lower Vaigai' and 'Terkku Upper watersheds' covering 60 micro-watersheds (Figure 8.1). Lower Vaigai watershed (4A2A1) has 46 micro-watersheds covering an area of 21,529.93 ha while Terkku Upper watershed (4A1D6) has 14 micro-watersheds covering an area of 7,249.62 ha (Table 28). In Thiruppulani Block out of 33 GPs, 28 GPs fall under Lower Vaigai watershed, five GPs under Terkku Upper watershed. (Tables 29). The micro-watershed related works are identified using Basin, Sub-basin, and micro-watershed with GP administrative boundaries through CWRM approach.

TABLE 28. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING THIRUPPULANI BLOCK

Macro-watershed	Area in ha	No. of Micro-watersheds
Lower Vaigai	21,529.93	46
Terkku Upper	7,249.62	14

TABLE 29. NO. OF GPS COVERED UNDER WATERSHEDS IN THIRUPPULANI BLOCK

Watershed Name	No. of GPs
Lower Vaigai	28
Terkku Upper	5

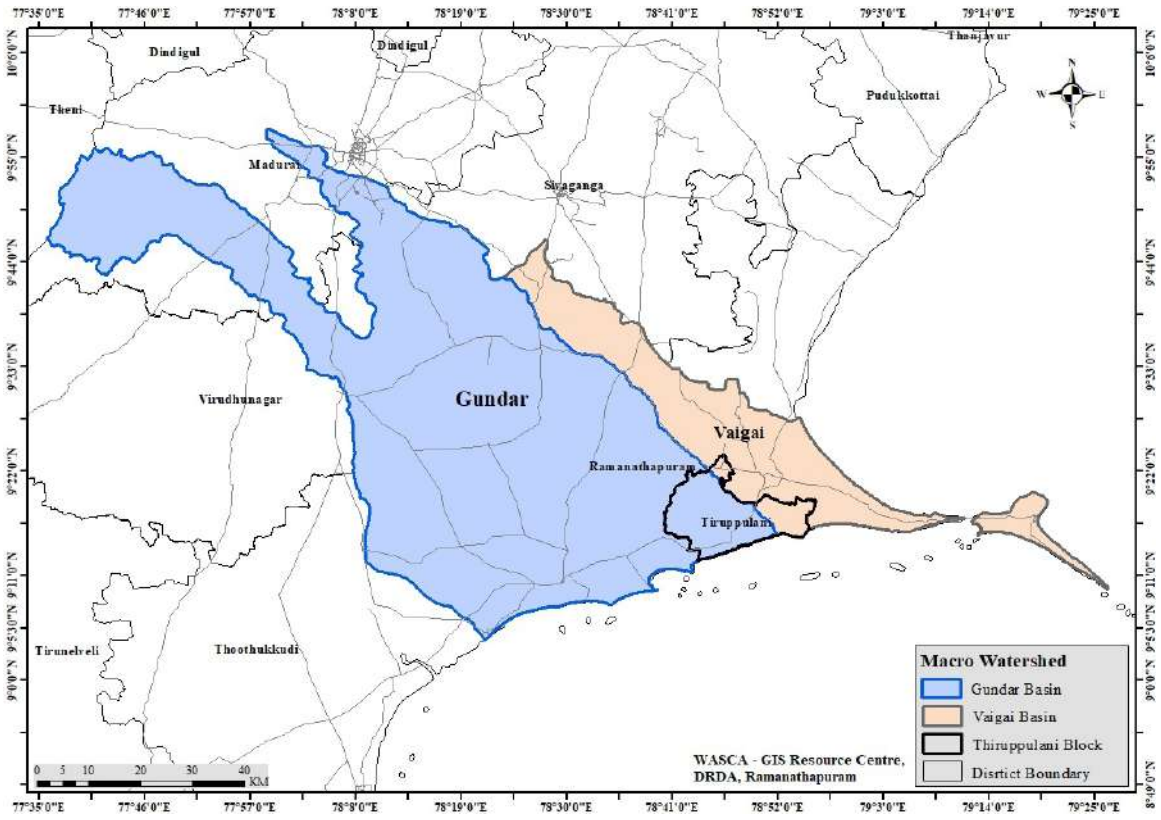


Figure 8.1. Macro-watershed map - Thiruppulani Block

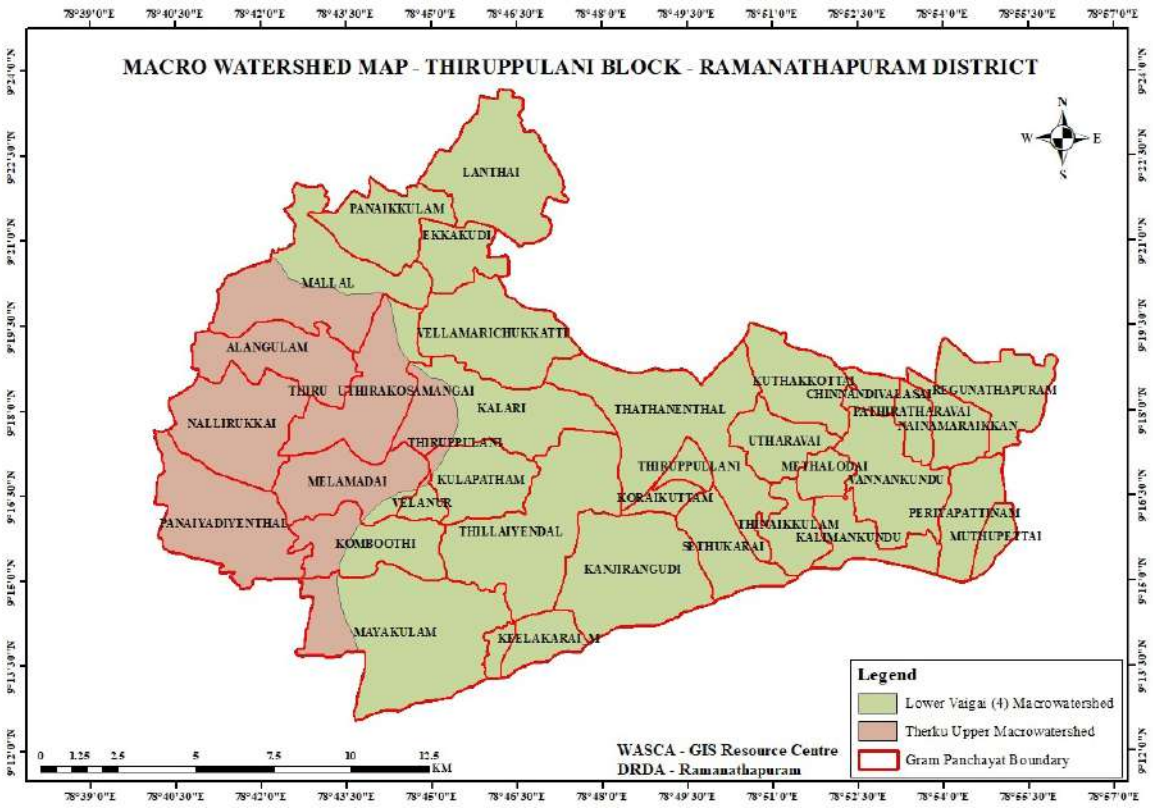


Figure 8.2. Macro-watershed with GPs

Understanding the Block area respect to its terrain nature aid in treating area with appropriate measurement at right place also ensures the well management of the watershed (micro or macro). Ridge-based Block area is mapped (zoning) by referring the spatial thematic datasets and showcased with macro-watershed (Table 30) and GPs boundaries (Table 31 & Figure 8.2). Based on ridge range types such as high, median, lower and inter variations Block area is distinguished into 4 kind of ridge zones.

All the proposed works are identified using basin, sub-basin, and Micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach. The ridge details, GPs proposed works in all Macro-watersheds in Thiruppulani Block are listed in Tables 30 to 35.

TABLE 30. MICRO-WATERSHED IN THIRUPPULANI BLOCK FALLING UNDER LOWER VAIGAI MACRO- WATERSHED

S.NO	Micro-watershed code	Micro-watershed Area in ha	Ridge Type
1	4A2A1d06a	443.0706852	Lower Ridge
2	4A2A1d07a	173.1480565	
3	4A2A1d01c	260.0301278	
4	4A2A1c02c	58.97826927	
5	4A2A1d08a	61.15637392	
6	4A2A1d08c	166.6377201	
7	4A2A1d08e	396.5959306	
8	4A2A1c05b	507.5160043	
9	4A2A1d10a	140.5345143	
10	4A2A1d06b	406.2515177	
11	4A2A1c07d	1,136.821666	
12	4A2A1b06c	33.17272755	
13	4A2A1c07c	747.5572249	
14	4A2A1c07b	334.6312046	

15	4A2A1b05e	248.7250043	Lower Ridge
16	4A2A1c06b	271.4168478	
17	4A2A1b06b	495.8303178	
18	4A2A1b08a	1180.787704	
19	4A2A1b08c	305.0024906	
20	4A2A1c06a	490.5168924	
21	4A2A1c07a	937.9500996	
22	4A2A1b05d	462.4232372	
23	4A2A1b06a	496.3362377	
24	4A2A1b05b	720.2664815	
25	4A2A1c08c	563.3563658	
26	4A2A1b08b	305.3440116	
27	4A2A1b08d	592.1321567	
28	4A2A1c08b	412.7938671	
29	4A2A1b05c	363.2349854	
30	4A2A1b10b	82.12219985	
31	4A2A1c04a	437.934079	
32	4A2A1b07c	770.9309681	
33	4A2A1b07a	35.26271477	
34	4A2A1b07b	1,112.635776	
35	4A2A1c08a	270.4855894	
36	4A2A1c08e	317.7392577	
37	4A2A1c08d	867.6052187	
38	4A2A1c03a	686.0786341	
39	4A2A1c03b	467.4546578	
40	4A2A1b05a	297.7114657	
41	4A2A1c04b	532.2127691	
42	4A2A1c03c	827.5372289	
43	4A2A1c09a	970.3923161	
44	4A2A1c04c	390.2484402	
45	4A2A1c09b	612.3468301	
46	4A2A1c09c	139.0091556	

TABLE 31. GPs FALLING UNDER CHEYYAR MACRO-WATERSHED

Sl.No	GP	Ridge type
1	Chinnandivalasai	Lower
2	Ekkakudi	
3	Kalari	
4	Kalimankundu	
5	Kanjirangudi	
6	Kompoothi	
7	Koraikuttam	
8	Kulapatham	
9	Kuthakkottai	
10	Landai	
11	Mallal	
12	Mayakulam	
13	Methalodai	

14	Muthupettai	Lower
15	Nainamaraikkan	
16	Panaikkulam	
17	Pathiratharavai	
18	Periyapattinam	
19	Regunathapuram	
20	Sethukkarai	
21	Thathanenthal	
22	Thillaiyendal	
23	Thinaikkulam	
24	Thiruppullani	
25	Utharavai	
26	Vannankundu	
27	Velanoor	
28	Vellamarichukkatti	

TABLE 32. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPES FALLING UNDER CHEYYAR MACRO-WATERSHED

Work wise Details of Cheyyar in Anakkavoor Block			
Sl. No.	**Proposed work**	**Ridge type**	**Extent**
1	Contour Continuous Bunds for Afforestation area (m)	Lower	8,822.5
2	Afforestation in Public/common lands (ha)		882.25
3	Drainage Line Treatment (m)		51,108.88
4	Block Plantation (Community) (ha)		4,111.25
5	Avenue plantation (Km)		113.2
6	Composting (No.)		439
7	Canal Bund Plantation (Km)		340.15
8	Restoration of waterbodies: Tanks and Ooranis (No.)		368
9	Artificial Recharge Structure (No.)		941
10	Farm Bunding with Boundary Trenches - Individual (ha)		2,112.89
11	Construction of Farm Ponds - Individual (No.)		439
12	Land development - Individual (ha)		548.02
13	Azolla units - Individual (No.)		131
14	NADEP Vermi compost (No.)		131
15	Fodder development - Community & Individual (No.)		131
16	Cattle Shelters (No.)		131
17	Goat Sheep Shelters (No.)		1,044
18	Cattle Trough (No.)		131
19	Soak Pits (Community) (No.)		369
20	Soak Pits (Individual) (No.)		3,714
21	Roof Rain Water Harvesting (No.)		56
22	Agro Forestry (ha)		882.5
23	Nutri Garden (No.)		28
24	Silt application (No.)		221
25	Mini Forest (ha)		67
26	Fish Drying Yard (No.)		20
27	Bird Watching Tower (No.)		10
28	Fish Processing Unit (No.)		20
30	Wetland Bund Strengthening (Km)		1,172.8

31	Wetland Bund Plantation (No.)	Lower	367
32	Wetland Inlet (No.)		2

TABLE 33. MICRO-WATERSHED IN THIRUPPULANI BLOCK FALLING UNDER TERKKU UPPER WATERSHED

Sl.No.	Micro-watershed code	Micro-watershed area in ha	Ridge type
1	4A1D6c03a	385.9270212	Lower
2	4A1D6c02c	349.6608626	
3	4A1D6c02a	773.0803243	
4	4A1D6c01c	528.8539686	
5	4A1D6c01a	1,644.10482	
6	4A1D6a08b	1,090.903708	
7	4A1D6c02b	632.5535574	
8	4A1D6c01b	228.3103362	
9	4A1D6b01a	53.48512317	
10	4A1D6a09c	575.516976	
11	4A1D6a09b	136.6912437	
12	4A1D6a08a	547.0171505	
13	4A1D6a09a	48.94735151	
14	4A1D6a05c	254.56615	

TABLE 34. LIST OF GPS WITH TYPE OF RIDGE FALLING UNDER TERKKU UPPER WATERSHED UNDER THIRUPPULANI BLOCK

S No	GP Name	Ridge type
1	Alankulam	Lower
2	Melamadai	
3	Nallirukkai	
4	Panaiyadiyenthal	
5	Thiru Uthirakosamangai	

TABLE 35. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER MACRO-WATERSHED TERKKU UPPER UNDER THIRUPPULANI BLOCK

Work wise Ridge Details of Terkku Upper in Thiruppulani Block			
Sl. No.	**Proposed work**	**Ridge type**	**Extent**
1	Contour Continuous Bunds for Afforestation area (m)	Lower	700.09
2	Afforestation in Public/common lands (ha)		70.09
3	Drainage Line Treatment (m)		5,132.88
4	Block Plantation (Community) (ha)		1,072.05
5	Avenue plantation (Km)		198.11
6	Composting (No.)		166
7	Canal Bund Plantation (Km)		559.4
8	Restoration of waterbodies: Tanks and Ooranis (No.)		64
9	Artificial Recharge Structure (No.)		216
10	Farm Bunding with Boundary Trenches - Individual (ha)		546.92
11	Construction of Farm Ponds - Individual (No.)		166
12	Land development - Individual (ha)		206.87
13	Azolla units - Individual (No.)		31
14	NADEP Vermi compost (No.)		31

15	Fodder development - Community & Individual (No.)	Lower	31
16	Cattle Shelters (No.)		31
17	Goat Sheep Shelters (No.)		439
18	Cattle Trough (No.)		31
19	Soak Pits (Community) (No.)		22
20	Soak Pits (Individual) (No.)		232
21	Roof Rain Water Harvesting (No.)		10
22	Nutri Garden (No.)		5
23	Silt application		82
24	Mini Forest		9

8.2 MODEL MICRO-WATERSHED CASE STUDY - VIVEKANANDHAPURAM MICRO-WATERSHED, THIRUPPULANI BLOCK

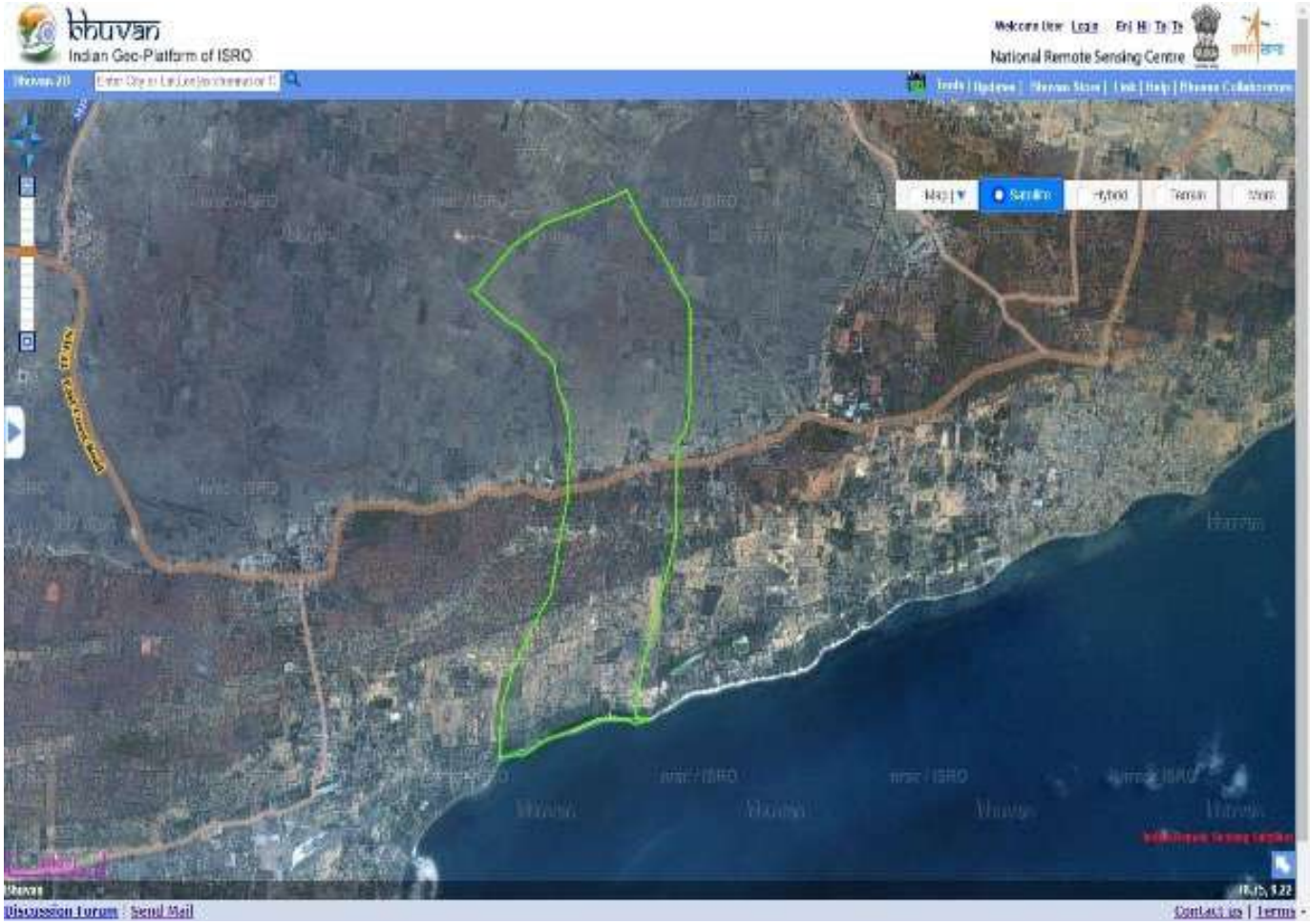


Figure 8.3. Vivekanandhapuram micro-watershed over satellite image

The micro-watershed case study addresses the issues of water conservation and climate change through integrated approach. The decentralized micro-watershed planning has been conceived for holistic development and management to ensure sustainable long-term benefits. The micro-watershed plan has been sequenced from ridge to valley for proper implementation of different development programs. This includes coordination of various natural components like groundwater, surface water, geology, hydrogeology, catchment, land use, soil, population, salt affected water along with various water resource supply and demand component. The ultimate goal is to achieve and maintain a balance between resources development to increase the welfare of the population.

VIVEKANANDHAPURAM MICRO-WATERSHED

Vivekanandhapuram micro-watershed falls under Mayakulam GP, Thiruppulani Block in Ramanathapuram District. Vivekanandhapuram micro-watershed over satellite image is shown in Figure 8.3. This micro-watershed is the part of Lower Vaigai (4) Macro- watershed in Uthirakosamangaiyar sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of are Vivekanandhapuram micro-watershed is given below in separate sections followed by proposed works, ridge wise proposed treatment area, estimated cost and required person days and key outcomes. (Table 36 to 46 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is Annexed 8.

TABLE 36. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the micro-watershed	Vivekanandhapuram
Micro-watershed number	4A2A1c09b
Name of the Basin	Gundar Basin
Name of the sub-basin	Uthirakosamangaiyar Sub Basin
Name of the macro-watershed	Lower Vaigai (4)
Number of GPs covered under the micro-watershed	1
Name of the GP	Mayakulam
Latitude of micro-watershed (From To)	9°12'32.248"N to 9°15'15.161"N
Longitude of micro-watershed (From To)	78°43'27.033"E to 78°44'27.959"E
Area of the micro-watershed in (ha)	614.6629 ha
Micro-watershed area in Mayakulam GP (%)	100
Area of micro-watershed falling in Mayakulam GP (ha)	614.6629
Length of the coastal line on Mayakulam GP (m)	4,530
Total population of Mayakulam GP	7,118
Annual Average Rainfall (mm)	821
Annual maximum Temperature (◦ C)	32.6
Annual Minimum Temperature (◦ C)	23.8
Evapo-Transporation losses of Mayakulam GP (ha.m)	65.43
Volumetric soil moisture availability (%)	17
Climate Risk	Drought and heat waves
CVI Index Value for Mayakulam (Based on WASCA Climate study)	0.482 (High Water Vulnerability, coastal vulnerability
Agro-Climatic Zone	Southern Zone (TN 05)
Agro Ecological Sub-Region (ICAR)	Hot dry semiarid eco sub region (18.1)
Status of Ground water in Mayakulam GP	Saline

TABLE 37. HYDROGEOLOGY OTHER CHARACTERISTICS IN MICRO-WATERSHED

Type of Geomorphology	Coastal Origin - Younger Coastal Plain
Geomorphology occurrence in %	100
Principle Aquifer	Alluvium
Salt Affected Area passing through the Micro-watershed	None
Type of lineaments passing through the micro-watershed	Geomorphic Lineaments, Parallel to Shore Line
Barren & waste lands (ha)	23 (Lower Ridge)

TABLE 38. CATCHMENT AREA OF MICRO-WATERSHED

Catchment Area Profile (Strange Methodology - CGWB)	
Catchment area in ha	**Mayakulam GP**
Good catchment area	101.0
Average catchment area	111.4
Bad catchment area	112.1

TABLE 39. GROUND WATER STATUS OF MICRO-WATERSHED

Name of the Firka (Assessment Unit) falling under micro-watershed	Keelakarai
Recharge from other sources during monsoon season (ha.m)	542.88
Recharge from other sources during non-monsoon season (ha.m)	291.98 ha.m

TABLE 40. SALINITY AND SEA WATER INTRUSION IN THE MICRO-WATERSHED

Pre-monsoon WQI	Medium and Poor Quality
Post monsoon WQI	Very Poor Quality
Pre- monsoon SMI	<=1
Post monsoon SMI	1-2

TABLE 41. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED

Water Budget in ha.m	Mayakulam GP
Water for domestic	19.49
Water for agriculture	451.3
Water for livestock's	2.22
Village wise water required	473.1
Available run-off from rain water (derived from Strange method)	473.1
Harvested Runoff from Water Harvesting Activities	36.5
Potential Harvesting from proposed Interventions	201.5
Total Water harvested	238
Water demand and Supply Difference	-235.1
Water demand supply gap status	deficient
Per capita Water Availability in cum	664.65
International Standard per capita water Availability (cum)	1,700
Water Availability Gap (cum)	-1,035.35
Water security status	Water Stress

TABLE 42. GP WISE PROPOSED MICRO-WATERSHED WORKS – MAYAKULAM GP

Ridge Type	Mayakulam GP (No.)
Upper	-
Middle	-
Lower	93
Total	93

TABLE 43. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED- MAYAKULAM GP

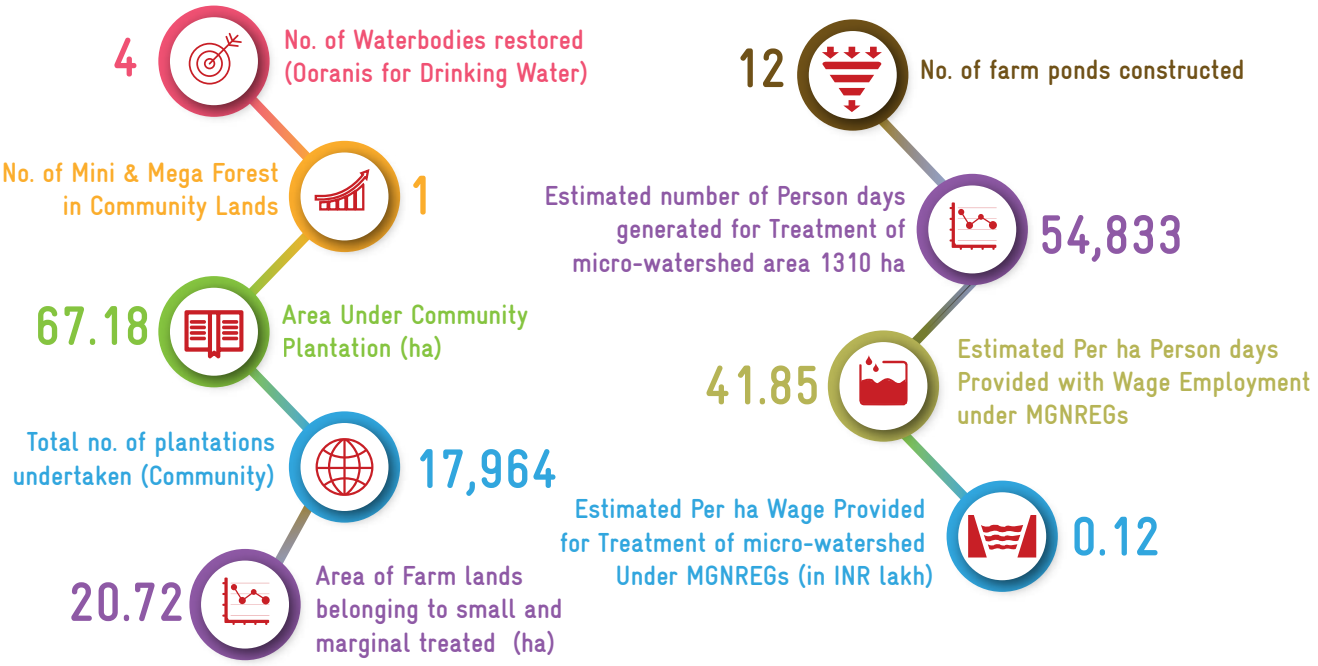
	Mayakulam GP
Upper Ridge	
No Upper falling in the GP	
Middle Ridge	
No Middle Ridge Falling in the GP	
Lower Ridge	
Estimated cost (INR in Lakhs)	108.25
Total area (ha)	572
Treatment cost (Lakhs/ha)	**0.189**
Estimated person days	**30,943**

Mayakulam GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.189 lakh/ha	30,943
TOTAL	0.189 lakh/ha	30,943

TABLE 44. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Total No.of works in Micro-watershed area (Arable, Non arable & DLT)	79
Total No. of works in Micro-watershed including livelihood Activities	19
Total No. of works in Micro-watershed including Rural Greywater Management Activities	45

TABLE 45. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Mayakulam GP	130.41 lakh

TABLE 46. ESTIMATES OF MICRO-WATERSHED IN MAYAKULAM GP

Sl. No	Proposed work	Ridge type	Status of Work	Extent	No. of works as per KML	Estima-teed cost INR in Lakhs	Person days
NRM works in Public and Community Lands							
1	Mini Forest (No.)	Lower	Completed	500	1	2.3	1,580
2	Afforestation (ha)		Not commenced	5.98	1	5.5	1,999
3	Avenue plantation (Km)			1.8	1	1.66	590
4	Block Plantation (ha)			7.1	1	6.53	2,376
5	Dry Land Horticulture (No.)			1	1	5	1,794
6	Oorani bund Plantation (No.)			797	6	3.67	1,306
7	Restoration of Traditional water-bodies: (Oorani & Tank) (No.)			4	4	28	10,256
8	Roof Rain Water Harvesting in GP Building (No.)			1	1	0.3	15
Sub total					**16**	**52.96**	**19,916**

Coastal Watershed Activities							
9	Coastal Shelter Belt Plantation * (Km)	Lower	Not commenced	1.61	1	2.3	1,580
10	Watch Tower			1	1	10	733
11	Sand Dunes Development * (No.)			1	1	2.3	1,580
Sub total					**3**	**14.6**	**3,893**
Works in Individual Farmer lands (Agriculture and Allied Activities)							
12	Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	10	10	3.6	220
13	Farm Bunding with Boundary Trenches - Individual (ha_			7.3 7	7	10.95	3,995
14	Construction of Farm Ponds - Individual (No.)			11	11	19.8	6,820
15	Composting (No.)			9	9	0.81	279
16	NADEP Vermi compost (ha)			0.5	1	0.12	5
17	Fodder development - Individual * (ha)			6	3		
Sub total					**41**	**35.28**	**11,319**
Total					**60**	**102.84**	**35,128**
Livelihood enhancement activities for Individual Farmers (Coastal Area)							
18	Azolla Production Unit (No.)	Lower	Not commenced	2	2	0.3	24
19	Cattle Shelters (No.)			3	3	4.8	33
20	Cattle Trough (No.)			2	2	0.4	22
21	Fish Drying Yard (No.)			2	2	12.38	216
22	Goat Sheep Shelters (No.)			3	3	3.45	90
23	Poultry Shed (No.)			2	2	4	44
Sub total					**14**	**25.33**	**429**
Rural Grey Water and Roof Rain Water Management							
24	Soak Pits (Individual) (No.)	Lower	Not commenced	12	12	1.29	72
25	Soak Pits (Community) (No.)			2	2	0.26	16
26	Nutri Garden (No.)			5	5	0.05	5
Sub total					**19**	**1.6**	**93**
Grand total					**93**	**129.77**	**35,650**

VIVEKANANDHAPURAM MICRO-WATERSHED DEVELOPMENT (GP WISE)

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Mayakulam GP	93	129.77	35,650

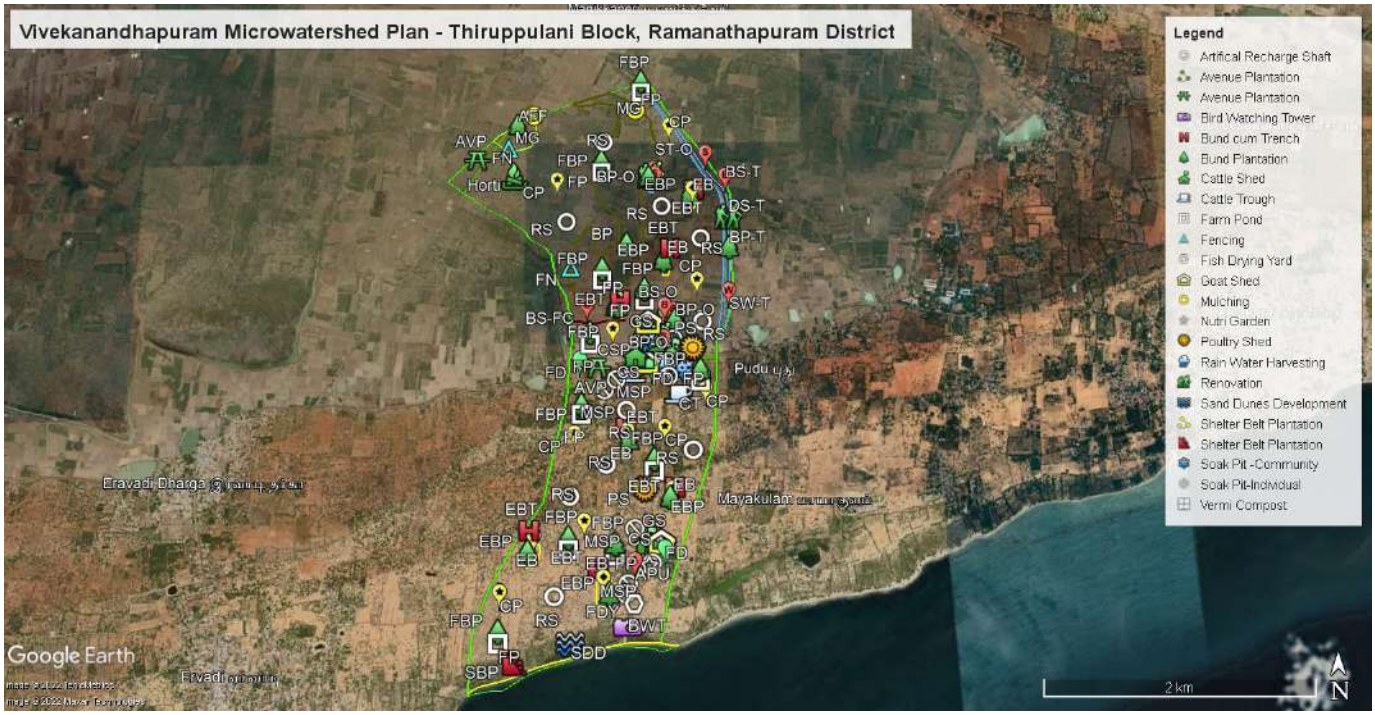


Figure 8.4. Proposed activities in Vivekanandhapuram Micro-watershed

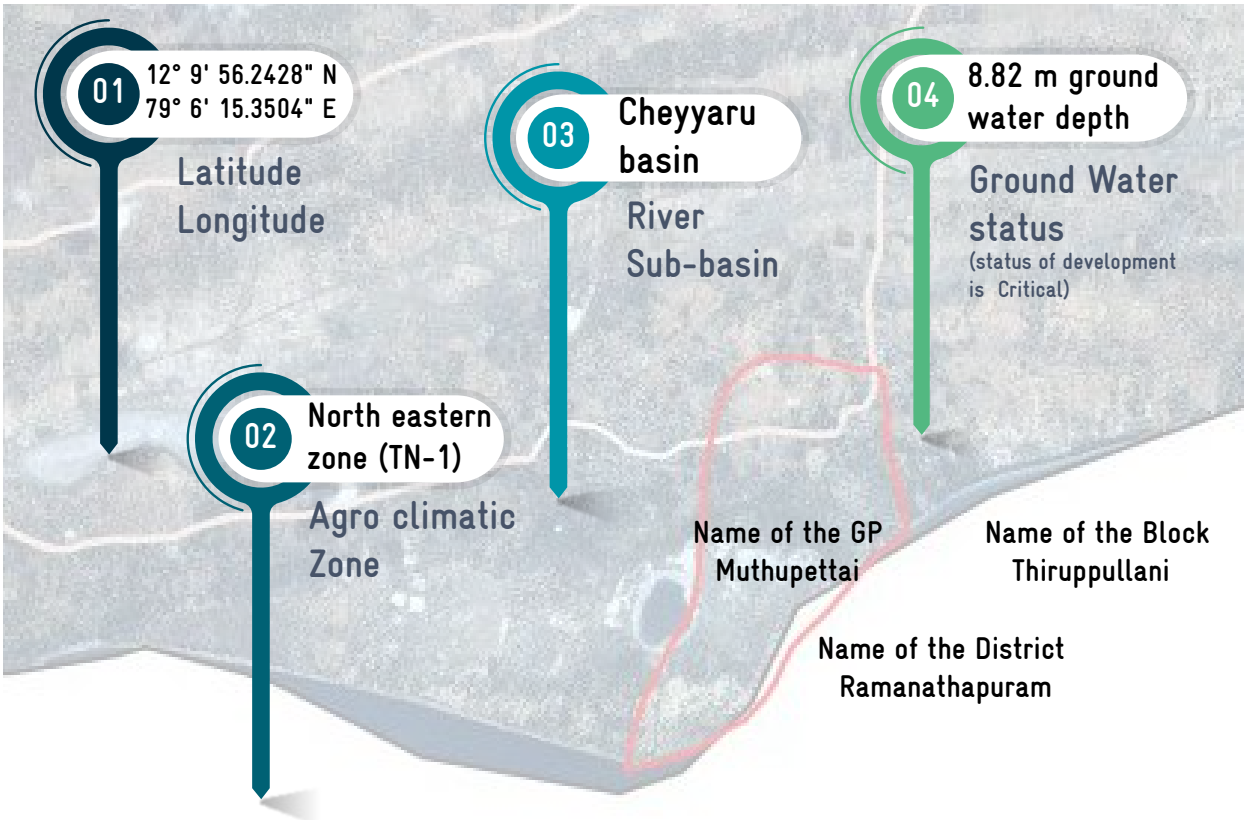
8.3 MODEL GP

MUTHUPETTAI GP, THIRUPPULLANI BLOCK

Figure 8.5. Muthupettai GP over satellite image

Muthupettai is situated near the coast of the Bay of Bengal, in the Thiruppullani Block of Ramanathapuram District TN. Geographically it is located between 12° 9' 56.2428" N to 12° 8' 26.7864""N & 79° 6' 15.3504" "E to 79° 6' 59.9502" E (Figure 8.5). The total geographical area of GP is 266 ha. The total population is 1,550 of which 689 are males and 861 are females as per Population Census 2011. The total number of households is 357. The Schedule Tribe population is nil Schedule Caste population is 1 in the Muthupettai village (Table 47). The average annual temperature of GP is 28.2 °C, and receives annual average rainfall of 821 mm.

TABLE 47. GENERAL DESCRIPTION OF MUTHUPETTAI GP, THIRUPPULLANI BLOCK



The detailed spatial and non-spatial data considered in the process of preparation of climate resilient under CWRM for Muthupettai GP is illustrated as follows:

8.3.1 CWRM PLANNING - SPATIAL DATA

CWRM adapted the geospatial technologies in its process of plan preparation towards climate-resilient infrastructure, Water Conservation Water Harvesting etc. at cadastral levels. Geospatial datasets allow players to understand the study area in terms of geomorphology, lineaments, salt-affected area, erosion, watershed, LULC, and wasteland. In some cases, spatial data will serve as a direct input for a particular activity to be implement towards conservation of resources. Various thematic datasets for Muthupettai GP shown in Figure 8.6 and discussed below,

Muthupettai GP engrossed with younger coastal plain (A) landform unit. It is observed that the groundwater prosperity is available in less than 30 m deep well with 30 to 50 LPM capacity (B). GP area is falls under two micro-watershed units (C). Flat to very flat range terrain is witnessed in GP (D). Most of land used for crop cultivation and mangrove swamp while barren land is noticed in small patches (E). One by fourth of GP area is wasteland (F).

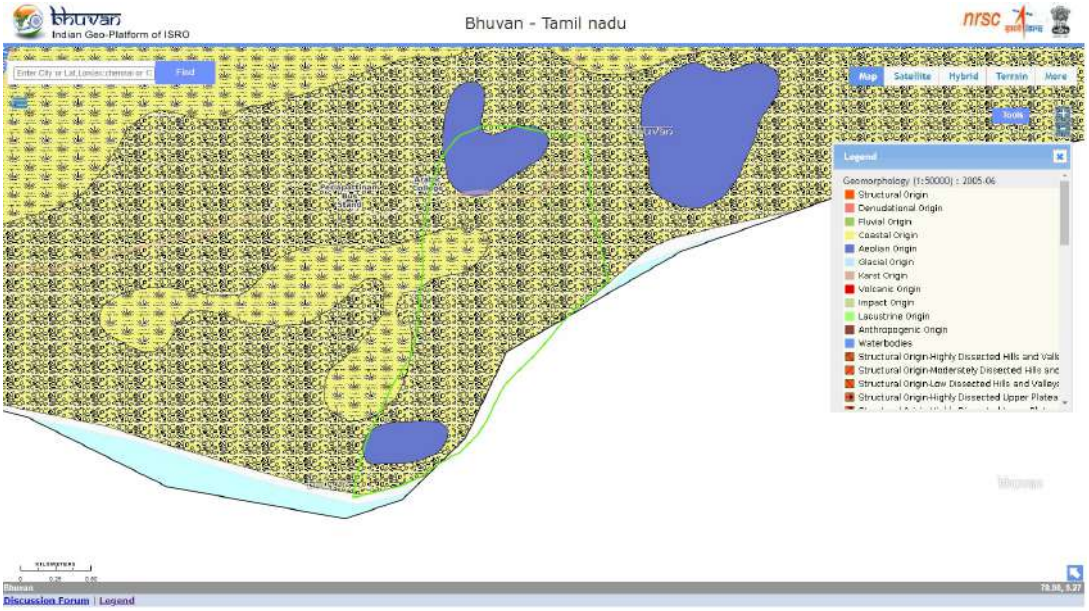


Figure 8.6.A. Geomorphology

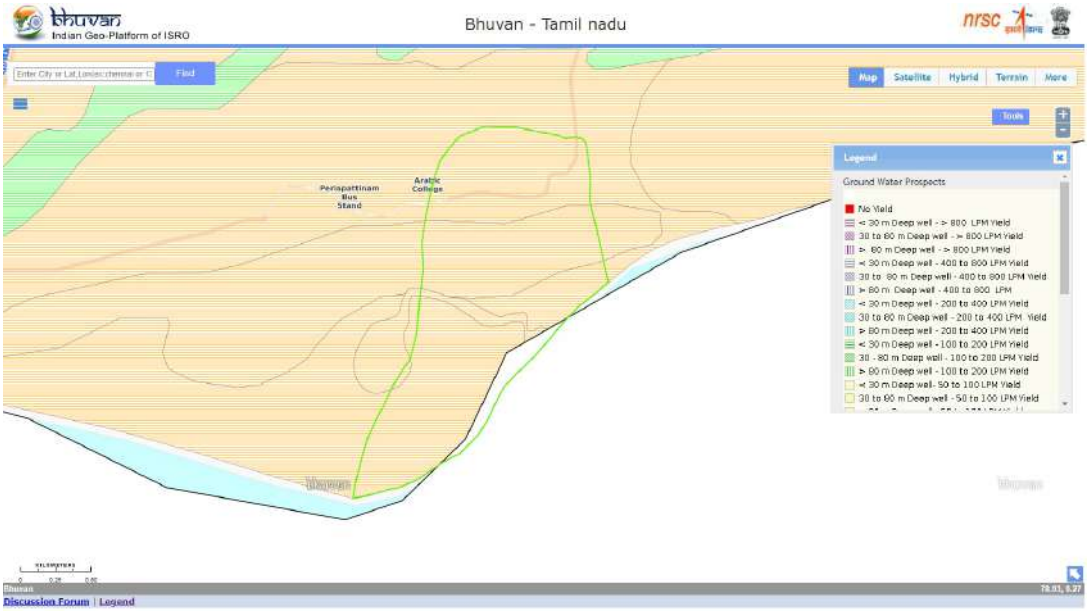


Figure 8.6.B. GW prosperity

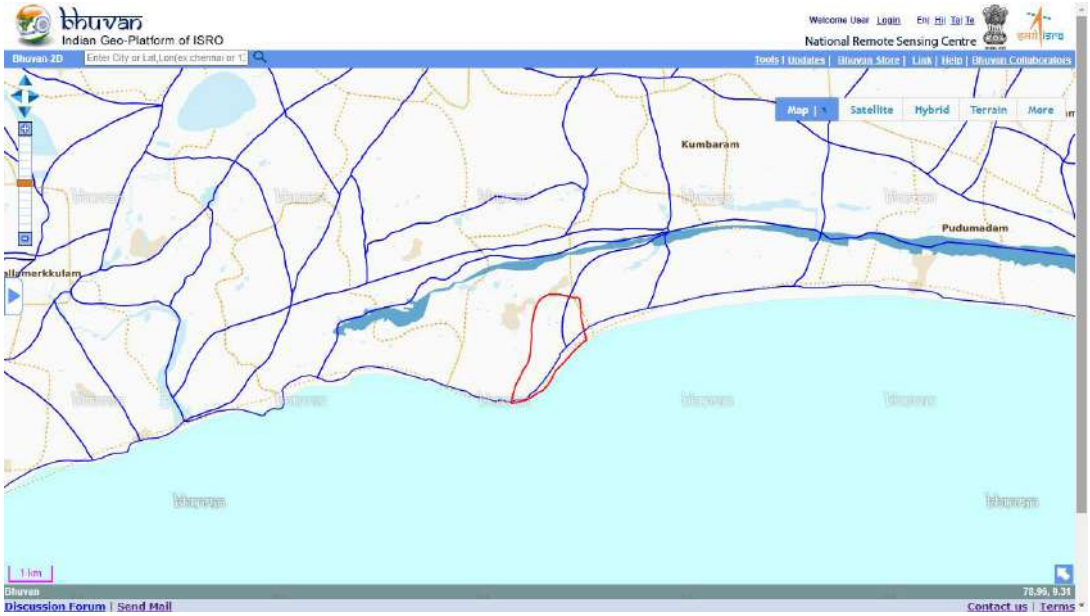


Figure 8.6.C. Watershed

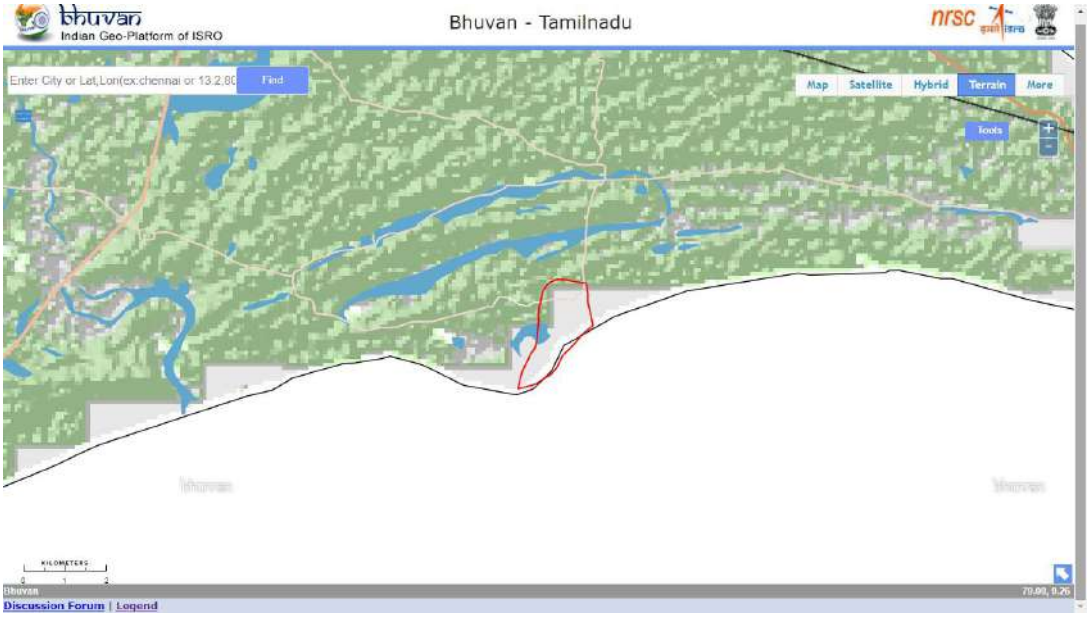


Figure 8.6.D. Terrain

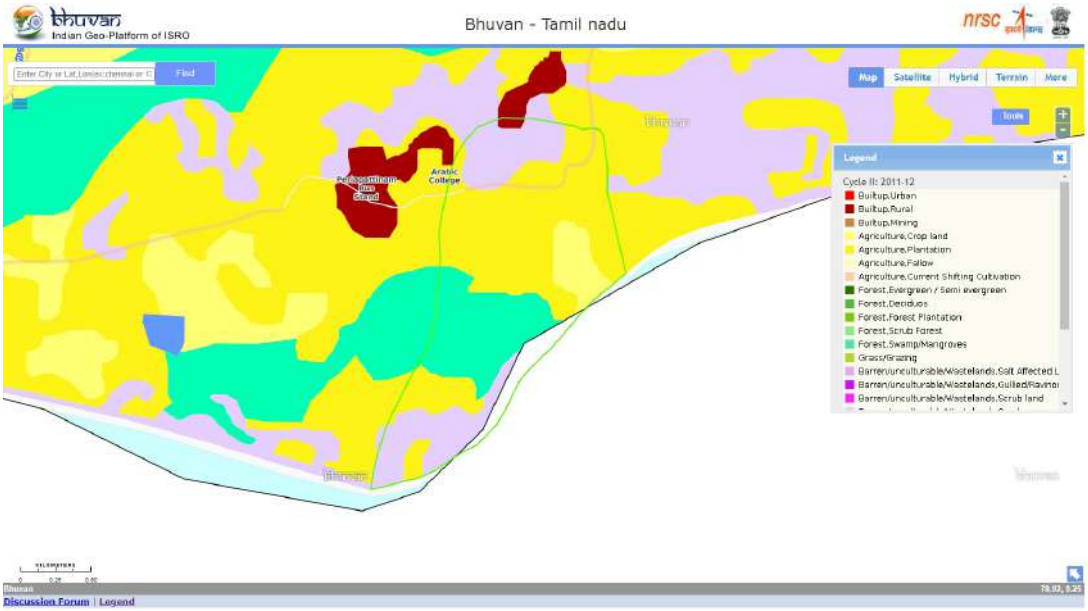


Figure 8.6.E. LULC

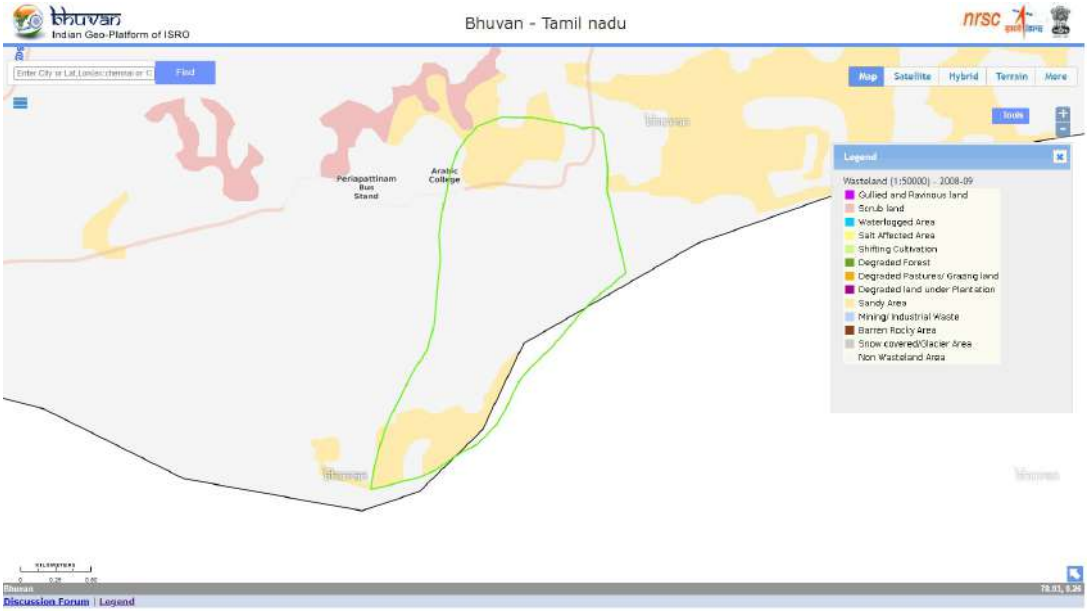


Figure 8.6.F. Wasteland

8.3.2 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covers four important themes socio-economic, climate, water and agriculture with 116 parameters (Table 48). These non-spatial data are concurrently used for analysis along with the spatial data mentioned above to identify the key water challenges, prepare water budget by understanding the supply and demand and develop water actions to the different land use and slope categories. The process started with mapping of the administrative (habitations/panchayat/revenue village, Block/thaluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub-basin) units keeping GP as the lowest unit of planning and execution.

TABLE 48. NON-SPATIAL DATA- MUTHUPETTAI GP

Key CWRM Parameter	Count
Climate Vulnerability Area - 1 : Socio-Economic	
Geographical Area (ha)	266
Male Population (No.)	689
Female Population (No.)	861
Total Population (No.)	1,550
SC Population (No.)	1
Vulnerable population (No.)	1
Households (HH's) (No.)	1,701
Only one room HH's (SECC) (No.)	256
Female Headed HH's (SECC) (No.)	54
Vulnerable Households (SECC) (No.)	195
Vulnerable Households (%)	11
Registered MGNREGA Job cards (No.)	524
The active person working in job Cards (No.)	234
Drinking Water Sources (No.)	106
HH's have tap water connection for drinking water (No.)	160
HH's dependent on other sources for drinking water (No.)	100
Annual Greywater Generation (ha.m)	3
Climate Vulnerability Area 2: Climate	
Average Annual Rainfall (mm)	821
Average Annual Temperature °C	28.2
Ground Water (G.W) Status (OE,CR,SC,Safe,Saline)	Saline
Climate Vulnerability Area 3: Water Resources	
Traditional waterbodies in numbers	
No. of Tanks (PWD & Union)	1
No. of Ooranis	6
Irrigation Facilities	
Area under Tank Irrigation (ha)	161.87
Area under Canal Irrigation (ha)	0.00

Area under Open & Tube Well Irrigation (ha)	0.00
Catchment Area wise Available Runoff in ha.m	
Good Catchment Area	2.70
Average Catchment Area	8.20
Bad Catchment Area	23.30
Run-Off Conserved (Existing) (ha.m)	
Good Catchment Area	1.56
Average Catchment Area	6.25
Bad Catchment Area	2.63
Watershed and Drainage Networks	
Number of Micro-watersheds (No.)	3
Water Demand in ha.m	
Water Demand for Humans	4
Water Demand for Livestock	0.38
Water Demand for Agriculture	223
% G.W Utilization for Drinking	96
% G.W Utilization for Livestock	64
% S.W Utilization for Drinking	4
% S.W Utilization for Livestock	36
% S.W Utilization for Agriculture	100
Climate Vulnerability Area 3: Agriculture	
Land Resources	
Non-Agricultural Uses (ha)	12.30
Land Under Miscellaneous Tree Crops etc.(ha)	48.40
Cultivable Waste Land (ha)	0.00
Current Fallow land (ha)	22.03
Unirrigated Land (ha)	183.02
Catchment Area	
Land under Good Catchment (ha)	12.30
Land under Average Catchment (ha)	48.40
Land under Bad Catchment (ha)	205.05
Crop Details	
Irrigated Area (ha)	245.49
Rainfed area (ha)	143.72
Area under Paddy Cultivation (ha)	55.35
Crop Water Requirement - Irrigated condition	124.68
Crop Water Requirement - Rainfed condition	98.13
Soil Resources: Status of Available Nitrogen (%)	
Very Low (VL)	100
Status of Organic Carbon in %	
Very Low (VL)	53

Low (L)	47
Medium (M)	0
Status of Soil Micro Nutrients in %	
Sufficient	51
Deficient	49
Status of Physical condition of the soil in %	
Moderately Alkaline (MAI)	100
Soil Texture in %	
% of Fine Soil	95
% of Coarse loamy	2
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture	43.09
ET Losses (ha.m)	120.80
Means of Water Extraction in %	
Gravity	64
Lifting	36
Irrigation Methods in %	
Wild Flooding	100
Livestock in No.	
Cattle Population	64
Sheep Population	25
Goat Population	347
Poultry	458

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. 256 one room households, and 54 female headed households.
2. Access to drinking water through tap water connections is very low
3. Grey water generation is 3 ha.m; which needs attention

Water

1. Ground water status - Saline
2. Seven traditional waterbodies in the GP
3. 100% Irrigation dependency on tanks
4. 100% agriculture needs met through surface water
5. 96 % drinking and 64% livestock needs met through groundwater
6. 34.2 ha.m of water is an available runoff -Runoff from bad catchment area is more

Agriculture and Allied Sector

1. 22.8 % of the land covers the common area
2. 77% of the land covers an individual land area
3. Main crop in the GP is paddy which is cultivated about 55.35 ha of land
4. Crop water requirement for irrigated condition is more
5. Irrigation by lifting methods is more than gravity method
6. Soil Nitrogen, organic carbon is very low
7. Moderately Alkaline soil
8. Fine soil is predominant in the GP
9. High ET loss 120.80 ha.m

8.3.4 PERSPECTIVE PLAN - WORKS PROPOSED: WATER ACTIONS

The appropriate and site-specific works are identified for the development of public and common land, agriculture and allied activities, rural infrastructures, and climate-resilient to reduce the vulnerability of the GP. About 23.85 % the total land area is taken for WASCA treatment activities like plantation and conservation works. In the total proposed area of 63.9 ha taken up for treatment, more attention is given for non-agriculture land followed by miscellaneous Tree crops, fallow lands other than current fallows and unirrigated land (Figure 8.7). Through the proposed conservation activities, 10.44 ha.m run off would be harvested in which, about 14.94% of the runoff from the good catchment, 59.86% of the runoff from the average catchment and 25.19% of the conservation from the bad catchment area (Figure 8.8).

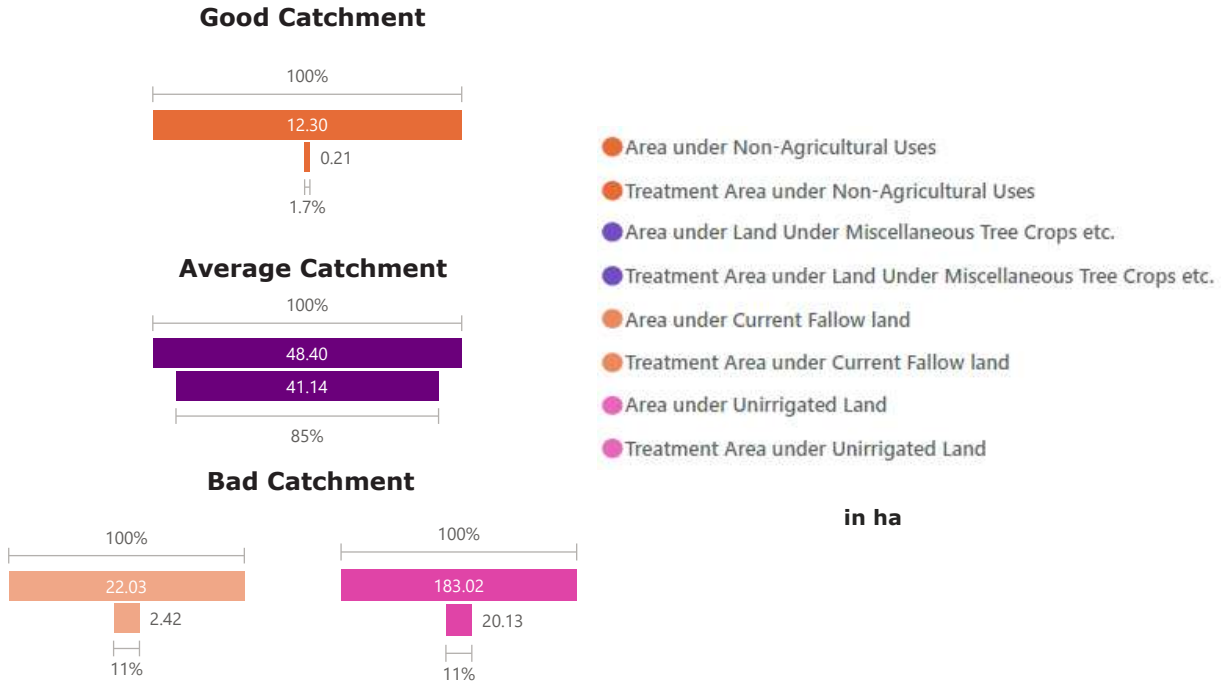


Figure 8.7. Proposed land resource treatment area in Muthupettai GP

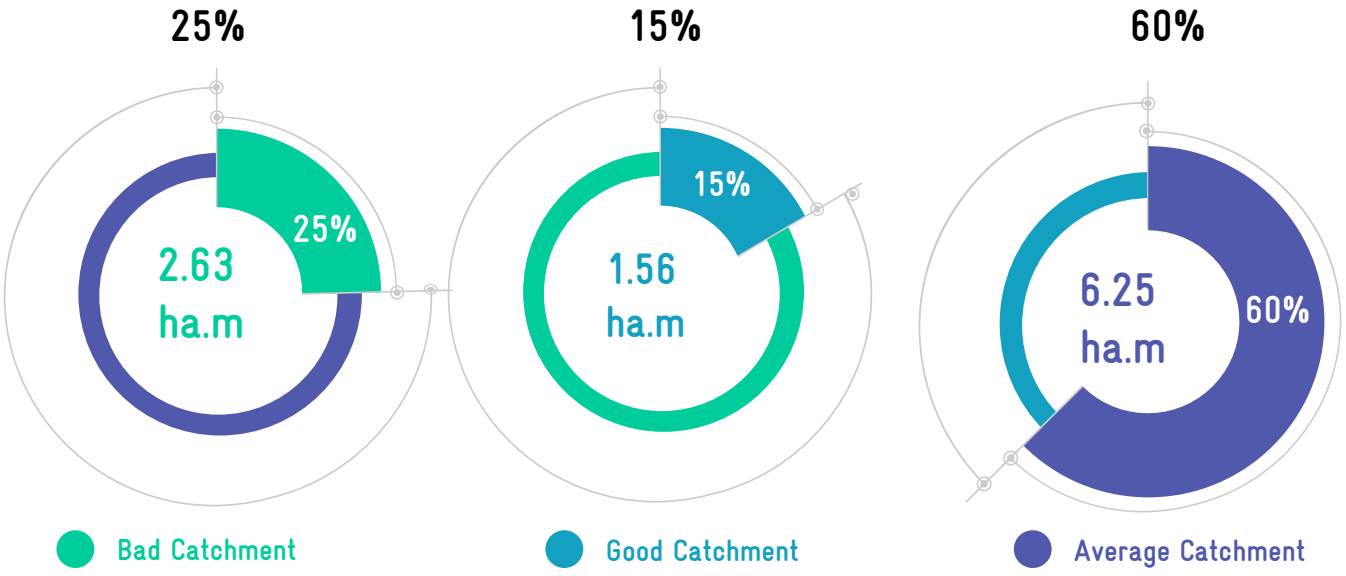


Figure 8.8. Expected run off conservation after treatment in Muthupettai GP

The detailed proposed activities along with silent parameters are showed in the Table 49 for 2021-2024. More attention towards common and public land developments are given with appropriate works to improve the resilience of the GP.

TABLE 49. PERSPECTIVE PLAN OF MUTHUPETTAI GP - FY (2021-2024)

CWRM Water Action 1: Improvement of Public & Common Lands Development				
Name of the work	**Ridge Type**	**No of Works**	**Estimated cost (INR in lakhs)**	**Estimated Person Days**
Afforestation in Public/common lands (ha)	Lower	0	1.81	702
Contour Continuous Bunds (CCB) for Afforestation area (m)		1	0.02	8
Composting (No.of Units)		9	1.53	135
Drainage Line Treatment (m)		10	0.30	50.5
Avenue plantation (Km)		2	3.74	1,461
Block Plantation (Community)		41	456.65	1,77,725
Deepening of waterbodies (No.)		7	17.00	2,000
Artificial Recharge Structure No. of units)		65	162.50	25,415
Subtotal of Public and common lands development		**135**	**643.55**	**2,07,496**
Coastal Watershed Works				
Fish Drying Yard	Lower	2	4.24	662
Coastal wetland - Bund strengthening		325	20.31	3,17,427
Bund Plantation wet lands		325	60.92	9,51,957
Subtotal of Coastal Watershed Works		**652**	**85.47**	**12,70,046**
Subtotal Water Action - I		**787**	**729.02**	**14,77,542**
CWRM Water Action 2: Agricultural and allied Sector development				
Farm Bunding	Lower	23	33.84	13,220
Construction of farm ponds (No.)		9	18.00	7,029
Land development (ha)		11	112.80	44,060
Cattle Shelters (No.)		2	4.24	662
Goat Sheep Shelters (No.)		4	9.08	1,420
Fodder development for cattle (No.)		2	2.96	4,688
Azolla units (No.)		2	0.30	46
Cattle Trough (No.)		2	0.10	12
Poultry shed (No.)		223	20.07	2,230
Dry land Horticulture/Agro-forestry (ha)		11	93.50	36,531
Vermi Compost (No.)		2	0.36	54
Subtotal Water Action - II		**291**	**295.25**	**1,09,952**
CWRM Water Action 3: Rural Water Management				
Soak pits (Community) (No.)	Lower	4	0.52	80
Soak pits (Individual) (No.)		36	3.60	576
Roof rain Water Harvesting (No.)		2	8.00	1,250
Community Tanka (Rajasthan Model)		1	30.00	300
Subtotal Water Action - III		**43**	**42.12**	**2,206**
Overall Total GP		**1121**	**1,066.39**	**15,89,700**

Regarding CWRM themes of the total number of projects identified, 66 % works are in agriculture and allied sector while 23% and 12 % works are in public and common land, and rural infrastructure respectively. Table 50 provides the estimates of the work budget, and personal days for three years from 2021-2024 in the Muthupettai GP.

TABLE 50. SUMMARY OF WORKS IDENTIFIED AND ESTIMATED PERSON-DAYS FOR 2021-2024

CWRM themes	No of works	Estimated budget (INR in lakhs)	Estimated person days
Public and common land development	787	729.02	14,77,542
Agriculture and Allied sector development	291	295.25	1,09,952
Rural water management	43	42.12	2,206
TOTAL	1,121	1,066.39	15,89,701

8.3.5 IMPACTS

The proposed water actions based on the above key water challenges cover a period of three years from 2021- 2022 to 2023-2024, At the end of the implementation period i.e. in the year 2024, the following impacts are envisaged (Table 51). It is expected that the impacts will potentially reduce the vulnerability and improve the resilience of the system to the projected climatic change events and ensure water security.

TABLE 51. WASCA- WATER ACTIONS AND INDICATORS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF PUBLIC AND COMMON LAND

	INDICATOR		OUTCOMES/ IMPACT
1	Number of water bodies restored in the village	1	24.02 percent of the total area treated under WASCA (63.90 ha)
2	Quantum of water harvested/recharge	2	27.2 ha.m surface runoff is harvested due to WASCA interventions
3	The proportion of land treated under WASCA	3	7 waterbodies restored
4	Area under afforestation	4	1.81 ha area under afforestation
5	Length of drainage line treated		

63.90 ha AREA TREATED

27.2 ha.m SURFACE RUNOFF HARVESTED

7 WATERBODIES RESTORED

1.81 ha AFFORESTATION

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR		OUTCOMES/ IMPACT
1.	Assessment of sources of water for livestock and agriculture demand	1.	9 farm ponds established
2.	No structures were established for on-farm (in-situ) water harvesting in drylands	2.	6 compost units for soil health improvement
3.	Improvement in soil health	3.	22.56 ha Farm bunding with trenches
4.	Changes in the irrigation practices	4.	11 ha under dryland horticulture
5.	Dryland development with agro-forestry	5.	2 vulnerable households established fodder plots
6.	Households established fodder plots		

9 FARM PONDS

6 COMPOST UNITS

22.56 ha FARM BUNDING

11 ha DRYLAND HORTICULTURE

2 FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

	INDICATOR
1.	Number of villages having complete solid and liquid waste management systems
2.	Roof rainwater harvesting measures
3.	Greywater drains
4.	Nutri gardens

	OUTCOMES/ IMPACT
1.	4 common and 36 individual soak pits were established for recycling greywater benefiting 357 households
2.	2 common roof rainwater harvesting and storage

4 COMMUNITY & **36**
INDIVIDUAL SOAK PITS

2
COMMON ROOF
RAINWATER HARVESTING

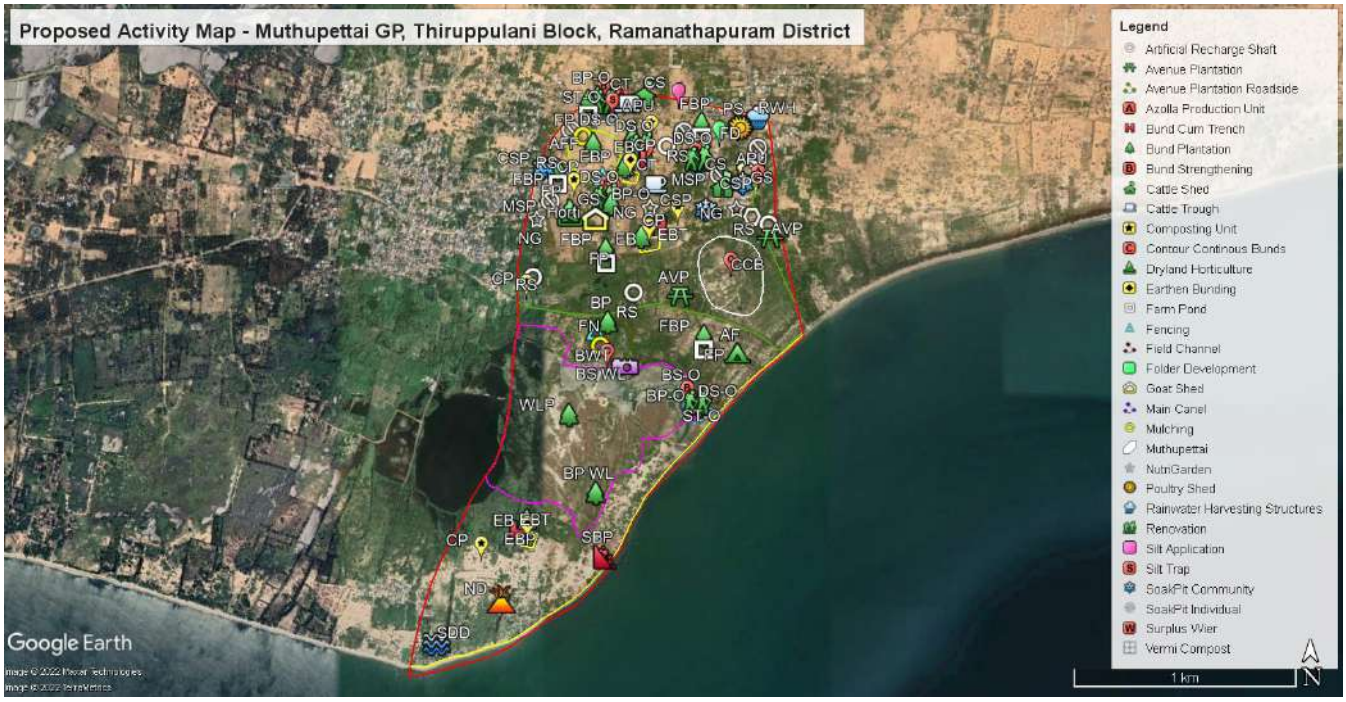
Table 52 provides both the perspective plan for three years' period and the annual plan for the one-year period from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 52. PROPOSALS FOR THE MGNREGS, MUTHUPETTAI GP, RAMANATHAPURAM DISTRICT

	No of works	No of person days
Perspective plan	1,121	15,89,701
Annual plan	448	6,35,880

8.3.6 PROPOSED ACTIVITY MAP

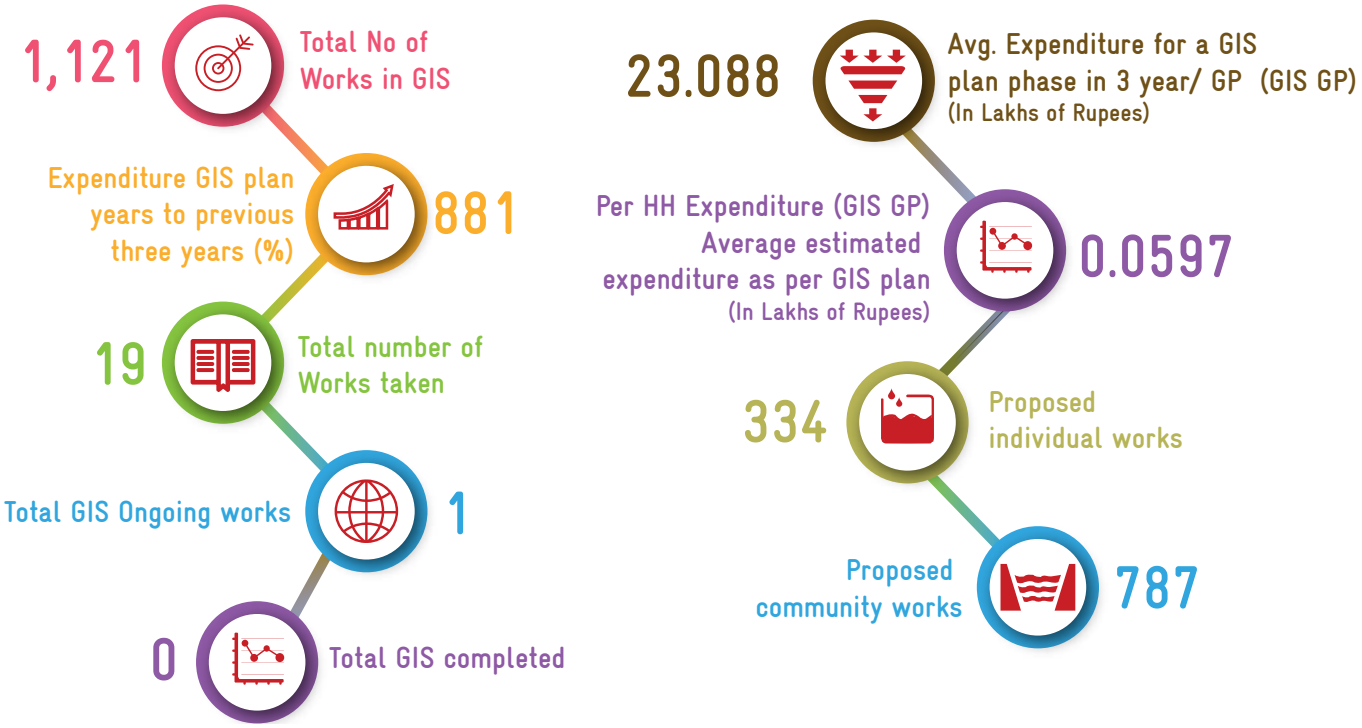
The proposed activity map (Figure 8.9) for Muthupettai GP, Thiruppullani Block shows a shelf of projects for all three year works from 2021-2024.



8.3.7 GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Thiruppullani Block is represented in Table 53.

TABLE 53. KEY PARAMETERS PERFORMANCE IN MUTHUPETTAI GP -THIRUPPULLANI BLOCK



நீர்இன்று அமையாது உலகெனின் யார்யார்க்கும்
வான்இன்று அமையாது ஒழுக்கு

குறள் - 20

Water is life that comes from rain
Sans rain our duties go in vain

Thirukkural - 20

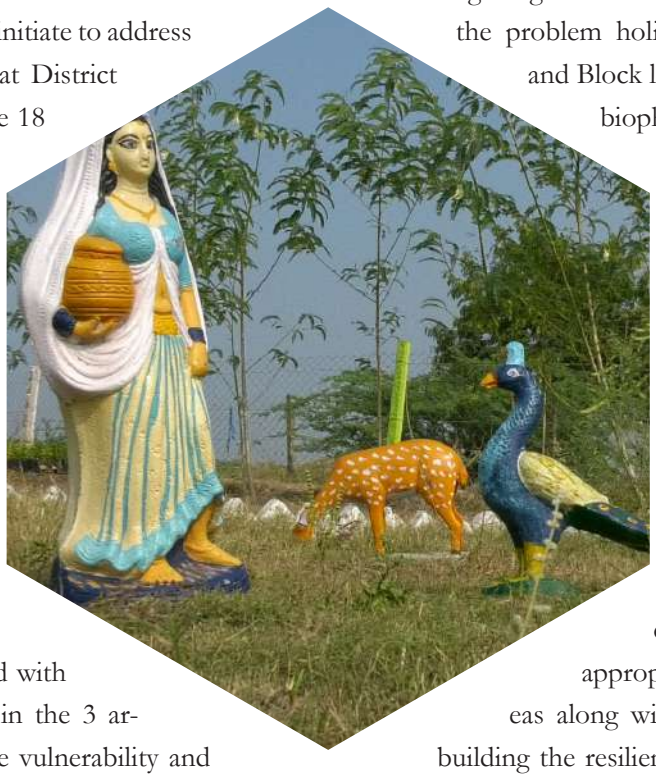
CHAPTER 9

CONCLUSION

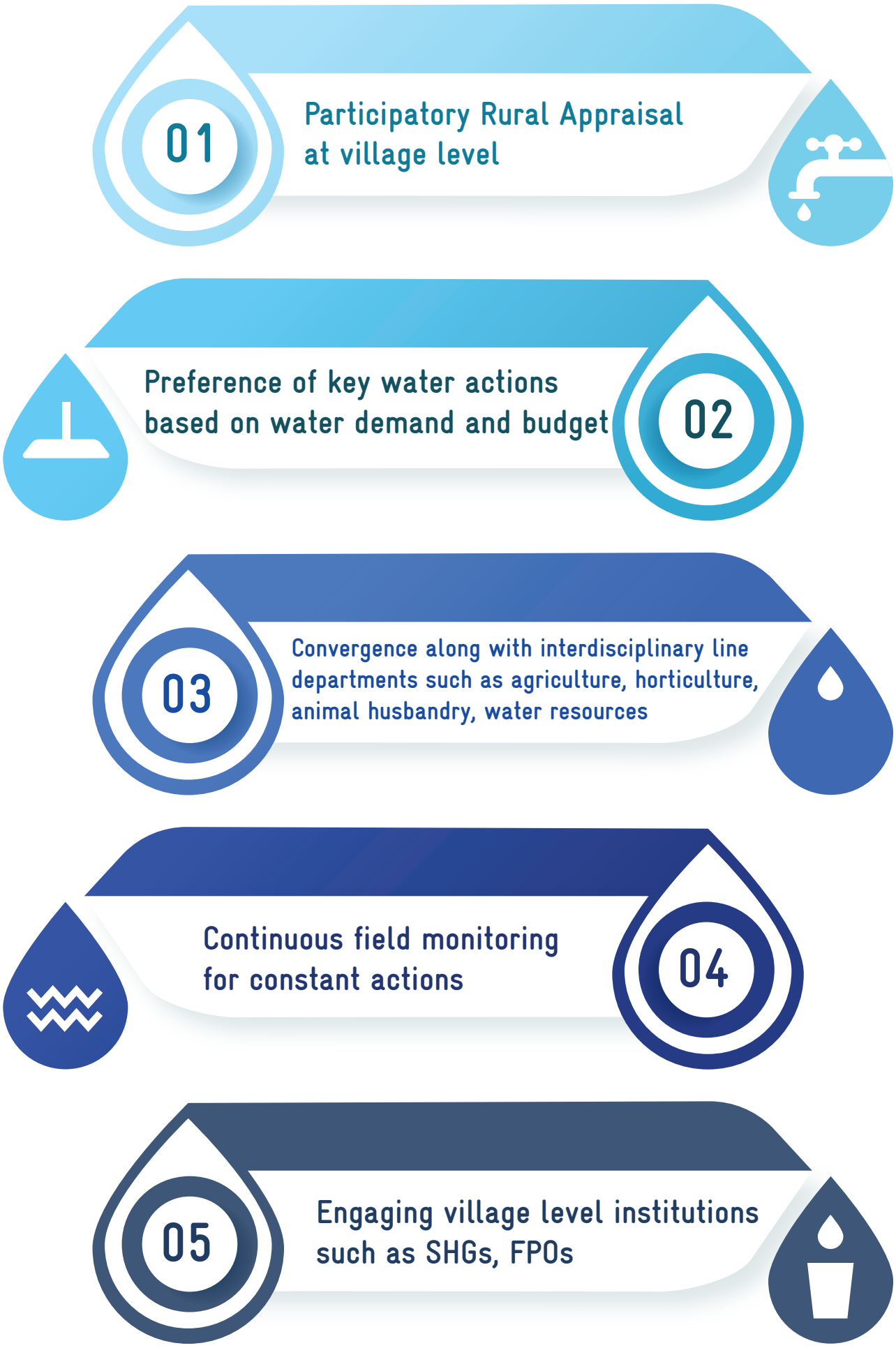
CONCLUSION

> **"WASCA TN took an initiative to address the problem holistically through comprehensive vulnerability assessment at district and block level to identify the vulnerable area and its key problems"**

In recent decades, the water demand is increasing at a fast rate due to rapid surge of population, industrial and economic growth. The evident changes in climate change and its extremities are bringing more threats to water security. Frequent monsoon failures lead to acute water scarcity and severe droughts. Thus, dependency on ground water has increased many folds during recent years that has resulted in lowering of ground water levels and even drying up of wells. WASCA TN took an initiate to address the problem holistically through comprehensive vulnerability assessment at District and Block level to identify the vulnerable area and its key problems. The 18 biophysical and socio-economic indicator of four interrelated areas via water, agriculture, socio-economic and climate used at District level are further expanded to 110 parameters at Block level. The spatial and non-spatial CWRM parameters for four above mentioned interrelated areas are used to represent risk, sensitivity and adaptive capacity of the GPs, which eventually reflects rural water security. The key problems of the Blocks are identified and the best possible adaptation options 'key water actions' are intended under WASCA initiatives in public and common land, agriculture and allied sector, rural infrastructure areas. All the indicators/parameters and key water actions are accompanied with appropriate SDG and India's NDC. The developmental activities in the 3 areas along with climate resilient measures will contribute in reducing the vulnerability and building the resilience of the local communities at the GP level. The GP based planning and integration at the Block level enables to adopt ecosystem approach in promoting nature based solutions. The productive impacts are visualized through convergence approach by mobilizing necessary finance, knowledge and technologies at the end of the three years of implementation. This integrated Block level approach will be more effective with Block level climate information which is not currently available.



Recommendations towards stable development and its progressive outcomes are,



ANNEXURES

ANNEXURE 1

TYPES OF GPS

Type of GP	Description
I	Both GP and revenue village data and boundary match
II	having more than one GPs in one Revenue Village
III	One GP is falling under more than Type 1 one Revenue Village
IV	GPs having more than one GP, one Revenue Villages data, boundary
V	Newly formed GP after 2011 census publication

* Note: The CWRM uses spatial and non-spatial data for developing Gram Panchayat level plans. Most of the data for non-spatial are available at revenue village level in the project area. To synchronize planning at GP keeping data availability and administrative boundary for GIS planning, various GP's are categorized based on revenue village boundaries, for collecting and organizing the datasets. Based on the above factors, five different types of GPs are classified as above.

ANNEXURE 3.1

KEY CWRM PARAMETER FROM SECONDARY SOURCES

Key CWRM Parameter	Secondary Source
Socio economic	
Geographical Area	Census-2011, MoHA, GOI *https://censusindia.gov.in/2011census/dchb/DCHB.html*
Male Population	
Female Population	
Total Population	
SC Population	
ST Population	
Vulnerable population	
Households (HH's)	Socio-economic caste census (SECC) 2011 *https://secc.gov.in/homePageLgd.htm*
Only one room HH's	
Female Headed HH's	
Vulnerable Households	
% of Vulnerable Households	
Registered MGNREGA Job cards	*http://mnregaweb4.nic.in/netnrega/app_issue.aspx?page=s&lflag=eng&state_name=TAMIL%20NADU&state_code=29&fin_year=2020-2021&source=national&Digest=3ics8+9Z9fEQ8yzj5E3qcQ*
Active person working in MGNREGA job Cards	
Water Resources	
Irrigation Facilities	Census-2011, MoHA, GOI *https://censusindia.gov.in/2011census/dchb/DCHB.html*
Area under Tank Irrigation	
Area under Canal Irrigation	
Area under Open & Tube Well Irrigation	
Water Quality	*https://ejalshakti.gov.in/IMISReports/Reports/WaterQuality/WQ/rpt_WQ_DistrictProfile_S.aspx?Rep=0&RP=Y*
Chemical Contaminants	
Bacterial and Other Contaminants	
Watershed and Drainage Networks	NRSC, ISRO, GoI
Length of Natural Drainage Lines	
Number of Natural Drainage Lines	
Number of Micro-watersheds	
Agriculture	
Land Resources	*https://censusindia.gov.in/2011census/dchb/DCHB.html*
Area under Forest land	
Area under Non-Agricultural Uses	
Area under Barren & Un-cultivable Land	
Area under Permanent Pastures and Other Grazing Land	
Area under Land Under Miscellaneous Tree Crops etc.	
Area under Cultivable Waste Land	
Area under Fallows Land other than Current Fallows	
Area under Current Fallow land	
Area under Unirrigated Land	
Area Irrigated by Source	

Soil Resources: Status of Available Nitrogen	*https://soilhealth.dac.gov.in/NewHomePage/NutriPage*
Very Low (VL)	
Low (L)	
Medium (M)	
High (H)	
Very High (VH)	
Status of Organic Carbon	
Very Low (VL)	
Low (L)	
Medium (M)	
High (H)	
Very High (VH)	
Status of Soil Micro Nutrients	
Sufficient	
Deficient	
Status of Physical condition of the soil	*https://soilhealth.dac.gov.in/NewHomePage/NutriPage*
Acidic Sulphate	
Strongly Acidic	
Highly Acidic	
Moderately Acidic	
Slightly Acidic	
Neutral	
Moderately Alkaline	
Strongly Alkaline	
Soil Texture	NRSC
% of Clay Soil	
% of Fine Soil	
% of Coarse loamy	
Soil Water Permeability	standard table
Soil moisture and ET	*https://indiawris.gov.in/wris/#/*
Volumetric Soil Moisture	
Livestock	*https://farmer.gov.in/livestockcensus.aspx*
Cattle Population	
Sheep Population	
Goat Population	
Poultry	

ANNEXURE 3.2

KEY CWRM PARAMETERS FROM PRIMARY SOURCES

Key CWRM Parameter	Primary Data
Water sources	
Drinking Water Sources	Block level officer/ GP level assistants
HH's have tap water connection for drinking water	
HH's dependent on other sources for drinking water	
Canal network	
Length of Main Canal	Block level officer/ GP level assistants
Length of Minor Canal	
Length of Distributaries	
Water Courses (Field Channels)	
Traditional water bodies	
Number of Tanks (PWD & Union)	Block level officer/ GP level assistants
Number of Ooranis	
Other Surface Water Bodies	
Crop details	
Irrigated Area	Village G return data
Rainfed area	
Area under Paddy Cultivation/irrigated	

ANNEXURE 3.3

KEY CWRM PARAMETER GENERATED -PRIMARY DATA

Key CWRM Parameter	Methods/Formulas Used
Water Demand	Standard Norms are in Annexure 3.4
Water Demand For Drinking	
Water Demand for Livestock	
Water Demand For Agriculture	
% G.W Utilization for Drinking	
% G.W Utilization for Livestock	
% G.W Utilization for Agriculture.	
% SW Utilization for Drinking	
% SW Utilization for Livestock	
% SW Utilization for Agriculture	
Annual Greywater Generation	Standard Norms are in Annexure 3.5
Available Runoff	Strange table method (based on rainfall, land area)
Run Off Conserved	Formula (based on tank storage, built up, linear measurement)
Estimated Soil Moisture	calculation & formula
ET Losses	calculation & formula
Means of Water Extraction (Gravity/ Lifting)	(Number of Gravity or lifting /Total number of extraction)*100
Irrigation Methods (Wild/Control)	(corresponding irrigation area/ total irrigation area)*100

ANNEXURE 3.4

STANDARD NORMS FOR CALCULATING WATER DEMAND

	Water Users	Total Annual Requirement (haM)
1	Human	population*0.0027375
2	Animals	Total water requirement for animals
3	Agriculture	Total volume of water in agriculture (Both irrigated and rainfed)
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**Requirement met by Ground Water**
1	Human	water demand for human* Ground water percentage (coming from drinking water sources)
2	Animals	water demand for animals* Ground water percentage (coming from Livestock table)
3	Agriculture	Total volume of water in irrigated source
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**Requirement met by Surface Water**
1	Human	water demand for human* Surface water percentage (coming from drinking water sources)
2	Animals	water demand for animals* surface water percentage (coming from Livestock table)
3	Agriculture	Total volume of water in rainfed source
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**% of Ground Water**
1	Human	Ground water percentage (coming from drinking water sources)
2	Animals	Ground water percentage (coming from Livestock table)
3	Agriculture	(Total volume of water in irrigated source/Total ground water requirement)*100
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category
	Water Users	**Requirement met by Surface Water**
1	Human	Surface water percentage (coming from drinking water sources)
2	Animals	surface water percentage (coming from Livestock table)
3	Agriculture	(Total volume of water in rainfed source/Total surface water requirement)*100
4	Others (Industrial)	
	Total water De-mand	Addition of all 4 category

* Based on the land use, slope, and soil type, the catchments are classified as good, average and bad. In the CWRM framework, we used land use as a key factor for the classicization of catchments.

Good catchment area: It consists of the runoff generated from sloppy lands with dense forest cover and areas where the ground is covered with a reduced rate of infiltration. It includes area under forest, area under non-agricultural use, barren and un-cultivable lands, and area under permanent pastures and other grazing land areas.

Average catchment area: It denotes the land uses related to the types of land under miscellaneous tree crops, culturable waste, and fallow land other than current fallow areas where the land surfaces are undulated terrain, moderately sloppy along with a medium infiltration rate.

Bad catchment area: It covers the area where the terrain is flat with very less vegetative cover, the land use categories under current fallow, total unirrigated and irrigated area with less surface runoff

ANNEXURE 3.5

STANDARD NORMS FOR GREY WATER GENERATION CALCULATION

	Waste water generation Source	Per day/unit waste water generation in L (Standard Value)
1	Bathing	15
2	Washing	10
3	Toilet	10
4	Cleaning	5
5	Cooking and cleaning Utensils	5
6	Others	5
	Total	**50**
	Waste water generation Source	**Daily volume of Grey water in L**
1	Bathing	Bathing water requirement in litres * Total population
2	Washing	washing water requirement in litres * Total population
3	Toilet	Toilet water requirement in litres * Total population
4	Cleaning	Cleaning water requirement in litres * Total population
5	Cooking and cleaning Utensils	cooking and cleaning utensils water requirement in litres * Total population
6	Others	other purpose water requirement in litres * Total population
	Total	**50*total population**
	Waste water generation Source	**Annual Grey water in CuM**
1	Bathing	(Daily volume of grey water for bathing in litres *365) / 1000
2	Washing	(Daily volume of grey water for washing in litres *365) / 1001
3	Toilet	(Daily volume of grey water for toilet in litres *365) / 1002
4	Cleaning	(Daily volume of grey water for cleaning in litres *365) / 1003
5	Cooking and cleaning Utensils	(Daily volume of grey water for cooking and washing utensils in litres *365) / 1004
6	Others	(Daily volume of grey water for other purposes in litres *365) / 1005
	Total	**(Total daily volume of grey water in litres *365)/ 1000**
	Annual Grey water generated in haM	**Annual Grey water in Cum/10000**

ANNEXURE 3.6

WATER QUALITY STANDARDS AND FORMULA USED

RELATIVE WEIGHTS ASSIGNED FOR DIFFERENT WATER QUALITY PARAMETERS

S. No.	Physical and chemical pa-rameters	World Health Organization (WHO 2004)	Weight (w)	Relative weight (wi)
1	pH	8.5	4	0.133
2	Total dissolved solids (mg/l)	500	5	0.167
3	Bicarbonate (mg/l)	200	1	0.033
4	Chloride (mg/l)	200	4	0.133
5	Sulphate (mg/l)	200	3	0.1
6	Nitrate (mg/l)	45	3	0.1
7	Calcium (mg/l)	75	2	0.067
8	Magnesium (mg/l)	30	2	0.067
9	Sodium (mg/l)	200	4	0.133
10	Potassium (mg/l)	100	2	0.067

$$SI_i = W_i \times Q_i \qquad WQI = \sum_{i=1}^{n} SI_i$$

Where qi is the quality rating, Ci is the concentration of individual element in water samples represented in mg/l and Si is the drinking water standard for individual chemical constituents (in mg/l)

Sea water mixing index (SMI) (Park et al. (2005)

$$SMI = a\ X\frac{C\ Na}{T\ Na} + b\ X\frac{C\ Mg}{T\ Mg} + c\ X\frac{C\ Cl}{T\ Cl} + d\ X\frac{CSO_4}{TSO_4}$$

The measurements a, b, c and d represent the relative concentration percentage of Na+, Mg2+, Cl- and SO42- assumed

ANNEXURE 3.7

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

S No	Gram Panchayat	Canal network				Tradational Water bodies	
Key CWRM Parameter		Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)
Type 1	Vellamaruchikatti	4,200	2,400	-	15,800	9	18
	Panayadiyenthal	-	-	-	2,100	8	11
	Utrakosamangai	2,300	1,000	-	4,500	1	11
	Komboothi	-	-	-	2,000	1	4
	Alangulam	4,500	1,500	-	3,000	2	8
	Landai	3,300	700	-	5,200	8	14
	Ekkakudi	3,200	-	-	4,000	3	8
	Kalari	-	3,000	-	7,000	2	14
	Kulapatham	-	-	-	3,000	4	10
	Nallirukai	2,600	1,800	-	6,800	2	12
	Panaikulam	4,200	500	-	13,000	9	9
	Kanjirangudi	-	-	-	800	1	12
Type 2	Kalimankundu	-	-	-	500	-	8
	Thinaikulam	-	-	-	1,000	-	7
	Methalodai	-	-	-	250	-	10
	Raghunathapuram	-	-	-	250	-	21
	Nainamarkkam	-	-	-	500	-	10
	Vannankundu	2,000	-	-	500	-	31
	Pathiratharavai	-	-	-	500	-	5
	Chinnandivalasai	-	-	-	500	-	5
	Thiruppulani	500	-	-	250	-	5
	Kooraikottam	-	-	-	250	-	3
	Sethukarai	2,000	-	-	500	-	6
	Thathanendal	7,000	-	-	500	-	10
	Kudhakottai	2,000	-	-	250	-	11
	Utharavai	2,000	-	-	250	-	22
	Velanur	3,000	-	-	5,000	-	5
	Melamadai	4,000	-	-	3,000	-	9
	Muthupettai	-	-	-	-	1	6
	Periyapattinam	-	-	-	-	-	9
Type 3	Mallai	9,000	4,000	2,000	8,000	-	18
	Mayakulam	-	-	-	-	3	13
	Thillaiyenthal	1,500	300	-	300	8	16

S No	Gram Panchayat	Irrigation Facilities (ha)			Catchment Area wise Available Runoff (ha.m)			Run Off Conserved (Exisiting) (ha.m)		
Key CWRM Parameter		Tank Irrigation	Canal Irrigation	Open & Tube Well Irrigation	Good Catchment Area	Average Catchment Area	Bad Catchment Area	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Type 1	Vellamaruchikatti	291	-	123	106	11	74	41	9	40
	Panayadiyenthal	68	-	11	24	48	99	18	37	16
	Utrakosamangai	98	-	37	60	99	34	20	80	1
	Komboothi	40	-	7	59	42	42	13	35	1
	Alangulam	166	-	-	40	-	80	14	-	20
	Landai	281	-	54	81	0	100	28	-	9
	Ekkakudi	122	-	55	25	33	21	1	28	2
	Kalari	323	-	-	30	143	49	17	113	7
	Kulapatham	249	-	4	35	30	47	18	26	2
	Nallirukai	55	-	106	84	61	49	28	58	18
	Panaikulam	216	-	43	38	20	50	28	18	19
	Kanjirangudi	360	-	101	103	80	74	37	75	12
Type 2	Kalimankundu	76	-	-	75	3	14	40	3	2
	Thinaikulam	54	-	-	75	3	14	39	3	2
	Methalodai	38	-	-	37	1	7	23	1	1
	Raghunathapuram	400	-	0	58	2	58	32	2	7
	Nainamarkkam	245	-	-	35	1	35	5	1	4
	Vannankundu	218	-	3	37	23	79	8	20	10
	Pathiratharavai	58	-	-	10	6	21	3	5	3
	Chinnandivalasai	45	-	-	8	5	16	1	4	2
	Thiruppulani	17	2	-	16	8	7	13	7	2
	Kooraikottam	17	-	-	16	8	7	10	7	2
	Sethukarai	54	8	-	49	26	21	26	22	5
	Thathanendal	197	-	54	179	93	76	37	81	18
	Kudhakottai	175	-	48	38	30	45	4	26	11
	Utharavai	127	-	35	28	22	33	14	19	8
	Velanur	28	-	-	10	1	13	5	1	1
	Melamadai	16	-	-	57	7	72	12	6	9
	Muthupettai	162	-	-	3	8	23	2	6	3
	Periyapattinam	47	25	15	3	8	23	2	6	3
Type 3	Mallai	137	-	445	85	38	114	44	6	-
	Mayakulam	112	-	65	101	111	112	9	98	95
	Thillaiyenthal	132	-	80	150	68	132	95	2	-

S No	Gram Panchayat	Watershed and Drainage Networks			Water Demand		
Key CWRM Parameter		Length of Natural Drainage Lines (m)	Number of Natural Drainage Lines (No.)	Number of micro-watersheds (No.)	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)
Type 1	Vellamaruchikatti	4,103	4	5	5	1	778
	Panayadiyenthal	38,842	4	8	3	1	518
	Utrakosamangai	1,834	4	6	6	1	378
	Komboothi	2,661	1	5	2	0	154
	Alangulam	1,140	1	6	4	3	483
	Landai	694,051	8	7	7	1	554
	Ekkakudi	1,415	1	5	7	0	227
	Kalari	5,461	4	8	4	1	590
	Kulapatham	-	-	6	5	1	514
	Nallirukai	4,537	4	6	3	1	375
	Panaikulam	5,886	7	6	2	1	412
	Kanjirangudi	2,606	2	4	20	2	346
Type 2	Kalimankundu	-	-	3	16	1	192
	Thinaikulam	-	-	5	16	1	192
	Methalodai	-	-	6	16	0	192
	Raghunathapuram	-	-	3	21	2	81
	Nainamarkkam	-	-	3	21	1	81
	Vannankundu	-	-	5	22	2	426
	Pathiratharavai	-	-	2	22	1	426
	Chinnandivalasai	-	-	2	22	0	426
	Thiruppulani	1,401	1	3	16	0	399
	Kooraikottam	667	1	5	16	0	399
	Sethukarai	555	1	6	16	1	399
	Thathanendal	14,757	10	11	16	2	399
	Kudhakottai	-	-	7	9	2	155
	Utharavai	-	-	6	9	2	155
	Velanur	590	1	4	8	1	432
	Melamadai	590	1	3	8	5	432
	Muthupettai	-	-	3	4	0	223
	Periyapattinam	-	-	5	4	0	223
Type 3	Mallai	10,404	7	9	9	2	867
	Mayakulam	2,407	5	8	19	2	451
	Thillaiyenthal	8,243	5	10	20	2	767

S No	Gram Panchayat	Water Demand					
Key CWRM Parameter		% GW Utilization for Drinking (%)	% GW Utilization for Livestock (%)	% GW Utilzation for Agriculture. (%)	% SW Utilization for Drinking (%)	% SW Utilization for Livestock (%)	% SW Utilization for Agriculture (%)
Type 1	Vellamaruchikatti	91	56	30	9	44	70
	Panayadiyenthal	94	54	14	6	46	86
	Utrakosamangai	91	67	27	9	33	73
	Komboothi	89	59	16	11	41	84
	Alangulam	90	70	-	10	30	100
	Landai	83	63	16	17	37	84
	Ekkakudi	92	46	31	8	54	69
	Kalari	90	75	-	10	25	100
	Kulapatham	91	86	2	9	14	98
	Nallirukai	98	41	66	2	59	34
	Panaikulam	100	32	17	-	68	83
	Kanjirangudi	94	50	22	6	50	78
Type 2	Kalimankundu	99	66	-	1	34	100
	Thinaikulam	97	66	-	3	34	100
	Methalodai	100	66	-	-	34	100
	Raghunathapuram	100	74	-	-	26	100
	Nainamarkkam	100	74	-	-	26	100
	Vannankundu	100	83	2	-	17	98
	Pathiratharavai	100	83	-	-	17	100
	Chinnandivalasai	99	83	-	1	17	100
	Thiruppulani	92	71	-	8	29	100
	Kooraikottam	92	71	-	8	29	100
	Sethukarai	100	70	-	-	30	100
	Thathanendal	92	71	21	8	29	79
	Kudhakottai	100	83	21	-	17	79
	Utharavai	47	83	21	53	17	79
	Velanur	100	16	-	-	84	100
	Melamadai	100	16	-	-	84	100
	Muthupettai	96	64	-	4	36	100
	Periyapattinam	96	64	-	4	36	100
Type 3	Mallai	100	46	66	-	54	34
	Mayakulam	97	66	37	3	34	63
	Thillaiyenthal	95	66	55	5	34	45

ANNEXURE 3.8

WATER QUALITY DURING PREMONSOON SEASON IN THIRUPPULANI BLOCK

Name of the GP	Name of the locations	Latitude	Longitude	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)	CO3 (mg/l)	HCO 3 (mg/l)	TH (mg/l)	Ca (mg/l)
Mayakulam	Pullandhai	E 78° 25' 58.292"	N 9° 10' 59.426"	7.56	0	2802	1685	409	115	266	402	153
Mayakulam	Mayakulam	E 78° 44' 48.109"	N 9° 13' 56.953"	7.61	0	383	221	418	96	296	46	21
Keelakarai_TP	Keelakarai	E 78° 47' 8.442"	N 9° 14' 6.331"	6.6	8	16713	10421	273	96	164	2874	890
Periyapattinam	Periyapattinam	E 78° 54' 4.608"	N 9° 16' 9.89"	7.1	0	1134	667	315	66	235	135	62
Sethukarai	Sethukarai	E 78° 50' 28.277"	N 9° 15' 11.023"	6.86	0	1267	731	300	121	154	480	80
Kalimankundu	Kalimankundu	E 78° 51' 15.62"	N 9° 16' 12.522"	7.14	0	720	451	321	56	215	86	39
Kalimankundu	Thinaikulam	E 78° 51' 48.175"	N 9° 15' 55.721"	7.08	0	2456	1429	314	99	196	1006	346
Thillaiyendhal	Thilanianthal	E 78° 47' 9.024"	N 9° 14' 54.532"	6.51	6	23550	14780	263	59	181	980	560
Kanjirangudi	Kanjirangudi	E 78° 48' 43.387"	N 9° 15' 7.002"	6.28	0	5250	3250	240	43	186	626	286
Keelakarai_TP	Keelakari outer	E 78° 47' 3.93"	N 9° 14' 31.171"	7.2	8	15812	10120	334	89	217	3561	1046
Thillaiyendhal	K Madurai	E 78° 46' 31.771"	N 9° 14' 29.785"	6.93	15	34580	21300	303	63	227	4122	1884
Thillaiyendhal	Palanchirai	E 78° 45' 28.94"	N 9° 15' 43.434"	7.23	1	14520	8290	336	85	218	1731	791
Kulapatham	Natham	E 78° 45' 18.335"	N 9° 16' 21.821"	7.28	1	11901	7564	348	99	226	1622	456
Melamadai	Melamadai	E 78° 44' 23.575"	N 9° 16' 38.95"	7.25	2	3471	2184	345	74	254	414	189
Panaiyadiyendhal	Mariyarayapuram	E 78° 41' 56.954"	N 9° 16' 37.934"	6.67	40	53900	32020	279	94	172	6425	2937
Panaiyadiyendhal	Panaiyadiyenthal	E 78° 41' 13.153"	N 9° 15' 59.692"	7.02	3	13380	8290	311	98	196	1595	729
Thiruuthrakosamangai	Uttarakosamangi	E 78° 44' 4.189"	N 9° 18' 54.752"	7.77	0	2408	1405	446	114	296	287	131
Alangulam	Kannankudi	E 78° 43' 7.255"	N 9° 19' 10.967"	7.56	0	5880	3711	386	101	256	1267	694
Vellamaruchukkatti	Kalari	E 78° 46' 12.518"	N 9° 18' 31.914"	7.77	0	2408	1405	448	108	327	287	131
Mallal	Mallal	E 78° 42' 17.266"	N 9° 19' 45.937"	7.72	0	458	229	440	92	314	55	25
Tiruppullani	Tiruppullani	E 78° 49' 29.179"	N 9° 17' 9.604"	7.2	0	6850	4230	334	87	217	817	373
Kuthakottai	Kattukavalka van valasi	E 78° 51' 30.002"	N 9° 18' 17.82"	7.37	0	3155	1977	372	97	242	440	80
Kuthakottai	Valimadaivalasai	E 78° 51' 40.943"	N 9° 18' 53.071"	6.73	4	14490	9230	286	69	186	1727	790
Raghunthapuram	Raghunthapuram	E 78° 55' 19.323"	N 9° 17' 36.824"	6.12	3	16840	9900	220	67	121	2761	1035
Landai	Mecca Nagar	E 78° 46' 18.048"	N 9° 22' 10.866"	7.52	33	47080	28520	406	96	294	5612	2566
Ekkakudi	Ekkakudi	E 78° 45' 2.498"	N 9° 20' 27.708"	7.9	0	3410	2105	467	92	334	407	186
Mallal	Malangudi	E 78° 43' 15.312"	N 9° 20' 55.77"	7.33	0	498	295	362	84	265	59	27
Landai	Karunkulam	E 78° 45' 19.919"	N 9° 22' 23.876"	7.34	6	1976	12400	321	67	235	2463	1406

Name of the GP	Name of the locations	Latitude	Longitude	Mg (mg/l)	Na (mg/l)	K(mg/l)	S04 (mg/l)	Cl (mg/l)	NO3 (mg/l)	WQI	SMI
Mayakulam	Pullandhai	E 78° 25' 58.292"	N 9° 10' 59.426"	96	285	16	240	810	24	194.4	0.881108116
Mayakulam	Mayakulam	E 78° 44' 48.109"	N 9° 13' 56.953"	12	86	16	11	110	8	40.3	0.092170085
Keelakarai_TP	Keelakarai	E 78° 47' 8.442"	N 9° 14' 6.331"	484	2016	86	25	6033	37	1096.2	3.041572744
Periyapattinam	Periyapattinam	E 78° 54' 4.608"	N 9° 16' 9.89"	35	137	6	7	286	6	76.9	0.17107831
Sethukarai	Sethukarai	E 78° 50' 28.277"	N 9° 15' 11.023"	45	118	12	23	321	10	85.7	0.211520606
Kalimankundu	Kalimankundu	E 78° 51' 15.62"	N 9° 16' 12.522"	22	89	8	15	214	8	57.9	0.141935108
Kalimankundu	Thinaikulam	E 78° 51' 48.175"	N 9° 15' 55.721"	563	114	20	11	352	13	253.7	0.30693278
Thillaiyendhal	Thilanianthal	E 78° 47' 9.024"	N 9° 14' 54.532"	381	1162	23	63	3984	14	988.2	2.058924048
Kanjirangudi	Kanjirangudi	E 78° 48' 43.387"	N 9° 15' 7.002"	160	667	18	14	1564	19	334	0.855769235
Keelakarai_TP	Keelakari outer	E 78° 47' 3.93"	N 9° 14' 31.171"	645	2040	28	126	7209	39	1218.1	3.720099951
Thillaiyendhal	K Madurai	E 78° 46' 31.771"	N 9° 14' 29.785"	1055	2406	21	64	7552	21	1795.9	3.928308897
Thillaiyendhal	Palanchirai	E 78° 45' 28.94"	N 9° 15' 43.434"	443	1154	16	89	4056	37	817.5	2.147072926
Kulapatham	Natham	E 78° 45' 18.335"	N 9° 16' 21.821"	308	1283	9	34	3558	23	2971.9	1.865638714
Melamadai	Melamadai	E 78° 44' 23.575"	N 9° 16' 38.95"	106	346	13	16	1102	37	231	0.574582272
Panaiyadiyendhal	Mariyarayapuram	E 78° 41' 56.954"	N 9° 16' 37.934"	1645	660	29	86	8609	140	2359.7	3.941723153
Panaiyadiyendhal	Panaiyadiyenthal	E 78° 41' 13.153"	N 9° 15' 59.692"	408	810	8	28	3581	33	744.8	1.734845221
Thiruuthrakosamangai	Uttarakosamangi	E 78° 44' 4.189"	N 9° 18' 54.752"	74	346	15	24	752	22	167.4	0.452498994
Alangulam	Kannankudi	E 78° 43' 7.255"	N 9° 19' 10.967"	321	108	14	43	1824	11	402.9	0.867715252
Vellamaruchukkatti	Kalari	E 78° 46' 12.518"	N 9° 18' 31.914"	74	252	10	29	451	16	139.6	0.320063658
Mallal	Mallal	E 78° 42' 17.266"	N 9° 19' 45.937"	14	53	5	20	58	11	36.3	0.080318325
Tiruppullani	Tiruppullani	E 78° 49' 29.179"	N 9° 17' 9.604"	209	486	2	37	2138	2	409.3	1.068857215
Kuthakottai	Kattukavalka van valasi	E 78° 51' 30.002"	N 9° 18' 17.82"	45	466	12	24	993	9	195.8	0.574331747
Kuthakottai	Valimadaivalasai	E 78° 51' 40.943"	N 9° 18' 53.071"	442	886	19	41	4464	29	853.1	2.121686658
Raghunthapuram	Raghunthapuram	E 78° 55' 19.323"	N 9° 17' 36.824"	761	1200	20	15	4871	17	1011.1	2.388757666
Landai	Mecca Nagar	E 78° 46' 18.048"	N 9° 22' 10.866"	1437	2128	15	16	5924	38	2056.9	3.21799357
Ekkakudi	Ekkakudi	E 78° 45' 2.498"	N 9° 20' 27.708"	104	489	16	34	1137	12	236	0.667321167
Mallal	Malangudi	E 78° 43' 15.312"	N 9° 20' 55.77"	15	89	4	22	74	11	41.7	0.101731091
Landai	Karunkulam	E 78° 45' 19.919"	N 9° 22' 23.876"	521	1263	26	50	5324	19	1113.2	2.596789627

ANNEXURE 3.9

WATER QUALITY DURING POST MONSOON SEASON IN THIRUPPULANI BLOCK

Name of the GP	Name of the locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)	CO3 (mg/l)	HCO 3 (mg/l)	TH (mg/l)
Mayakulam	Pullandhai	E 78° 25' 58.292"	N 9° 10' 59.426"	Open well	6.85	0	3098	1921	591	146	438	204
Mayakulam	Mayakulam	E 78° 44' 48.109"	N 9° 13' 56.953"	Bore well	7.02	0	10830	6715	726	155	563	741
Keelakarai_TP	Keelakarai	E 78° 47' 8.442"	N 9° 14' 6.331"	Bore well	7.64	0	800	496	215	23	168	68
Periyapattinam	Periyapattinam	E 78° 54' 4.608"	N 9° 16' 9.89"	Open well	7.12	0	1132	702	197	54	135	87
Sethukarai	Sethukarai	E 78° 50' 28.277"	N 9° 15' 11.023"	Open well	7.22	0	1649	1022	394	24	338	136
Kalimankundu	Kalimankundu	E 78° 51' 15.62"	N 9° 16' 12.522"	Open well	7.71	0	858	532	216	42	156	74
Kalimankundu	Thinaikulam	E 78° 51' 48.175"	N 9° 15' 55.721"	Open well	7.21	0	1362	844	331	57	143	116
Thillaiyendhal	Thilanianthal	E 78° 47' 9.024"	N 9° 14' 54.532"	Open well	7.39	0	1807	1120	258	87	159	137
Kanjirangudi	Kanjirangudi	E 78° 48' 43.387"	N 9° 15' 7.002"	Bore well	7.42	0	956	593	146	34	97	81
Keelakarai_TP	Keelakari outer	E 78° 47' 3.93"	N 9° 14' 31.171"	Open well	7.59	0	815	505	165	32	123	74
Thillaiyendhal	K Madurai	E 78° 46' 31.771"	N 9° 14' 29.785"	Open well	6.25	10	22380	13876	1138	231	896	1623
Thillaiyendhal	Palanchirai	E 78° 45' 28.94"	N 9° 15' 43.434"	Open well	7.26	0	8620	5344	768	224	526	641
Kulapatham	Natham	E 78° 45' 18.335"	N 9° 16' 21.821"	Open well	7.17	1	9720	6026	816	239	563	802
Melamadai	Melamadai	E 78° 44' 23.575"	N 9° 16' 38.95"	Bore well	6.6	0	8540	5295	884	222	653	615
Panaiyadiyendhal	Mariyarayapuram	E 78° 41' 56.954"	N 9° 16' 37.934"	Bore well	6.55	28	38290	23740	1258	253	987	2835
Panaiyadiyendhal	Panaiyadiyenthal	E 78° 41' 13.153"	N 9° 15' 59.692"	Open well	7.24	0	3638	2256	1127	252	786	279
Thiruuthrakosamangai	Uttarakosamangi	E 78° 44' 4.189"	N 9° 18' 54.752"	Open well	7.45	0	167	104	43	6	36	25
Alangulam	Kannankudi	E 78° 43' 7.255"	N 9° 19' 10.967"	Bore well	7.2	0	5800	3596	628	183	435	443
Vellamaruchukkatti	Kalari	E 78° 46' 12.518"	N 9° 18' 31.914"	Bore well	7.62	0	2814	1745	723	140	561	191
Mallal	Mallal	E 78° 42' 17.266"	N 9° 19' 45.937"	Open well	7.46	0	203	126	45	3	40	22
Tiruppullani	Tiruppullani	E 78° 49' 29.179"	N 9° 17' 9.604"	Open well	7.2	0	1084	672	256	26	221	91
Kuthakottai	Kattukavalka van valasi	E 78° 51' 30.002"	N 9° 18' 17.82"	Open well	7.14	0	1264	784	299	45	238	95
Kuthakottai	Valimadaivalasai	E 78° 51' 40.943"	N 9° 18' 53.071"	Open well	6.62	4	10770	6677	1036	154	867	649
Raghunthapuram	Raghunthapuram	E 78° 55' 19.323"	N 9° 17' 36.824"	Open well	7.12	0	3960	2455	317	89	217	275
Landai	Mecca Nagar	E 78° 46' 18.048"	N 9° 22' 10.866"	Bore well	6.54	23	26980	16728	1297	279	986	1826
Ekkakudi	Ekkakudi	E 78° 45' 2.498"	N 9° 20' 27.708"	Bore well	6.89	0	3244	2011	347	96	242	238
Mallal	Malangudi	E 78° 43' 15.312"	N 9° 20' 55.77"	Open well	7.45	0	1138	706	251	33	189	86
Landai	Karunkulam	E 78° 45' 19.919"	N 9° 22' 23.876"	Bore well	7.22	0	1021	633	138	15	110	83

Name of the GP	Name of the locations	Latitude	Longitude	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	S04 (mg/l)	Cl (mg/l)	NO3 (mg/l)	WQI	SMI
Mayakulam	Pullandhai	E 78° 25' 58.292"	N 9° 10' 59.426"	102	86	134.4	29.4	186	235	16.86	142.6	0.582
Mayakulam	Mayakulam	E 78° 44' 48.109"	N 9° 13' 56.953"	342	384	466	84	195	1064	62	481.7	0.844
Keelakarai_TP	Keelakarai	E 78° 47' 8.442"	N 9° 14' 6.331"	26	31	46	7.6	48.04	81	4.353	50.1	2.146
Periyapattinam	Periyapattinam	E 78° 54' 4.608"	N 9° 16' 9.89"	28	46	76	12	38	183	12	69.9	0.271
Sethukarai	Sethukarai	E 78° 50' 28.277"	N 9° 15' 11.023"	56	68	83	26	116	168	25	95.3	0.315
Kalimankundu	Kalimankundu	E 78° 51' 15.62"	N 9° 16' 12.522"	26	37	43	10	43	69	17	54.4	0.168
Kalimankundu	Thinaikulam	E 78° 51' 48.175"	N 9° 15' 55.721"	43	58	66	13	62	146	26	82.4	0.251
Thillaiyendhal	Thilanianthal	E 78° 47' 9.024"	N 9° 14' 54.532"	56	68	89	18	89	198	34	101.4	1.373
Kanjirangudi	Kanjirangudi	E 78° 48' 43.387"	N 9° 15' 7.002"	30	38	48	11	62	96	23	61.1	0.788
Keelakarai_TP	Keelakari outer	E 78° 47' 3.93"	N 9° 14' 31.171"	34	29	37	9	34	96	16	52.9	2.165
Thillaiyendhal	K Madurai	E 78° 46' 31.771"	N 9° 14' 29.785"	735	864	1017	136	224	2966	128	1043.9	4.261
Thillaiyendhal	Palanchirai	E 78° 45' 28.94"	N 9° 15' 43.434"	273	356	426	95	206	1172	86	435.2	1.995
Kulapatham	Natham	E 78° 45' 18.335"	N 9° 16' 21.821"	368	421	462	57	216	1334	32	479.8	2.226
Melamadai	Melamadai	E 78° 44' 23.575"	N 9° 16' 38.95"	276	328	416	99	140	956	28	395.6	1
Panaiyadiyendhal	Mariyarayapuram	E 78° 41' 56.954"	N 9° 16' 37.934"	1356	1461	1262	168	238	6452	186	1825.5	4.324
Panaiyadiyendhal	Panaiyadiyenthal	E 78° 41' 13.153"	N 9° 15' 59.692"	124	147	162	67	187	304	29	181.6	1.162
Thiruuthrakosa-mangai	Uttarakosamangi	E 78° 44' 4.189"	N 9° 18' 54.752"	10	6	8	3	11	15	4	20.5	0.371
Alangulam	Kannankudi	E 78° 43' 7.255"	N 9° 19' 10.967"	186	243	286	74	167	525	66	283.7	0.552
Vellamaruchukkatti	Kalari	E 78° 46' 12.518"	N 9° 18' 31.914"	96	83	146	27	146	267	18	137.7	0.529
Mallal	Mallal	E 78° 42' 17.266"	N 9° 19' 45.937"	12	6	10	2	14	16	7	22.4	0.075
Tiruppullani	Tiruppullani	E 78° 49' 29.179"	N 9° 17' 9.604"	33	47	58	8	67	102	8	63.4	0.612
Kuthakottai	Kattukavalka van valasi	E 78° 51' 30.002"	N 9° 18' 17.82"	43	38	56	13	57	106	16	67.7	0.584
Kuthakottai	Valimadaivalasai	E 78° 51' 40.943"	N 9° 18' 53.071"	348	284	526	119	227	1097	89	474.3	1.692
Raghunthapuram	Raghunthapuram	E 78° 55' 19.323"	N 9° 17' 36.824"	146	117	182	55	183	327	23	183.8	1.564
Landai	Mecca Nagar	E 78° 46' 18.048"	N 9° 22' 10.866"	968	834	1167	92	268	3321	159	1193.3	4.189
Ekkakudi	Ekkakudi	E 78° 45' 2.498"	N 9° 20' 27.708"	121	98	143	31	143	296	26	154.6	0.785
Mallal	Malangudi	E 78° 43' 15.312"	N 9° 20' 55.77"	33	39	47	8	53	116	10	63.1	0.2
Landai	Karunkulam	E 78° 45' 19.919"	N 9° 22' 23.876"	43	32	49	9.7	58	91.5	5.556	57.5	1.391

GP WISE STATUS OF AGRICULTURE RESOURCE

ANNEXURE 3.10

S No	Gram Panchayat	Land Resources (ha)						
Key CWRM Parameter		Non-Agricultural Uses	Unirrigated Land	Area Irrigated by Source	Land Under Miscellaneous Tree Criticalops etc.	Current Fallow land	Culturable Waste Land	Fallows Land other than Current Fallows
Type 1	Vellamaruchikatti	478	48	15	119	29	92	414
	Panayadiyenthal	107	282	-	35	232	524	79
	Utrakosamangai	270	580	-	-	81	83	135
	Komboothi	266	248	-	3	104	211	47
	Alangulam	179	-	-	-	124	410	166
	Landai	366	-	2	-	335	261	281
	Ekkakudi	112	192	-	-	-	11	176
	Kalari	136	720	119	22	12	77	323
	Kulapatham	158	177	-	20	2	136	253
	Nallirukai	380	359	-	-	-	274	161
	Panaikulam	170	118	-	-	7	178	258
	Kanjirangudi	464	471	-	4	17	168	461
Type 2	Kalimankundu	336	17	-	-	-	48	76
	Thinaikulam	336	17	-	-	-	48	76
	Methalodai	168	8	-	-	-	24	38
	Raghunathapuram	259	11	-	-	0	106	400
	Nainamarkkam	159	7	-	-	0	65	245
	Vannankundu	166	37	98	-	3	473	218
	Pathiratharavai	44	10	26	-	1	125	58
	Chinnandivalasai	34	8	20	-	1	97	45
	Thiruppulani	70	43	4	3	5	34	17
	Kooraikottam	70	43	4	3	5	34	17
	Sethukarai	223	136	14	9	15	106	54
	Thathanendal	808	493	51	32	54	386	197
	Kudhakottai	171	148	26	3	48	174	175
	Utharavai	124	107	19	2	35	126	127
	Velanur	46	7	0	-	-	84	28
	Melamadai	259	39	1	-	-	474	158
	Muthupettai	12	48	-	-	22	183	-
	Periyapattinam	12	48	-	-	22	183	-
Type 3	Mallai	382	221	-	-	137	420	445
	Mayakulam	455	654	-	29	107	507	344
	Thillaiyenthal	675	401	-	25	57	632	448

S No	Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
Key CWRM Parameter		Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Type 1	Vellamaruchikatti	478	63	654	416	166	566	614	164
	Panayadiyenthal	107	282	870	111	586	163	126	392
	Utrakosamangai	270	580	300	151	213	260	211	167
	Komboothi	266	248	365	43	174	57	57	97
	Alangulam	179	-	700	165	322	329	201	282
	Landai	366	2	877	285	167	397	395	159
	Ekkakudi	112	192	187	174	3	139	224	3
	Kalari	136	839	434	360	131	402	466	124
	Kulapatham	158	177	411	244	158	391	358	156
	Nallirukai	380	359	434	162	257	212	180	196
	Panaikulam	170	118	443	262	41	275	373	39
	Kanjirangudi	464	471	651	475	110	77	266	80
Type 2	Kalimankundu	336	17	123	113	172	107	58	134
	Thinaikulam	336	17	123	113	172	107	58	134
	Methalodai	168	8	62	113	172	107	58	134
	Raghunathapuram	259	11	506	-	85	78	-	81
	Nainamarkkam	159	7	310	-	85	78	-	81
	Vannankundu	166	135	694	331	271	249	165	261
	Pathiratharavai	44	36	184	331	271	249	165	261
	Chinnandivalasai	34	28	143	331	271	249	165	261
	Thiruppulani	70	47	58	29	377	381	24	376
	Kooraikottam	70	47	58	29	377	381	24	376
	Sethukarai	223	150	184	29	377	381	24	376
	Thathanendal	808	544	669	29	377	381	24	376
	Kudhakottai	171	174	400	6	154	146	4	152
	Utharavai	124	126	289	6	154	146	4	152
	Velanur	46	7	111	178	195	311	257	175
	Melamadai	259	40	631	178	195	311	257	175
	Muthupettai	12	48	205	245	144	55	125	98
	Periyapattinam	12	48	205	5	88	55	3	73
Type 3	Mallai	382	221	1,002	443	300	638	571	296
	Mayakulam	455	654	987	73	324	206	103	348
	Thillaiyenthal	675	401	1,162	499	321	379	423	343

S No	Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)			Status of Organic Carbon (%)				
Key CWRM Parameter		Very Low	Low	Medium	Very Low	Low	Medium	High	Very High
Type 1	Vellamaruchikatti	81	19	-	19	80	2	-	-
	Panayadiyenthal	9	91	-	26	68	6	-	-
	Utrakosamangai	100	-	-	74	26	-	-	-
	Komboothi	15	85	-	19	74	8	-	-
	Alangulam	35	65	-	36	21	42	-	1
	Landai	100	-	-	68	32	-	-	-
	Ekkakudi	28	55	17	10	90	-	-	-
	Kalari	52	48	-	2	-	-	-	98
	Kulapatham	1	99	-	2	54	44	-	-
	Nallirukai	100	-	-	1	94	5	-	-
	Panaikulam	99	1	-	20	69	2	8	2
	Kanjirangudi	75	25	0	48	45	3	4	-
Type 2	Kalimankundu	100	-	-	81	19	-	-	-
	Thinaikulam	100	-	-	81	19	-	-	-
	Methalodai	100	-	-	81	19	-	-	-
	Raghunathapuram	79	21	-	1	-	-	30	70
	Nainamarkkam	79	21	-	1	-	-	30	70
	Vannankundu	22	78	0	1	5	75	18	-
	Pathiratharavai	22	78	0	1	5	75	18	-
	Chinnandivalasai	22	78	0	1	4	76	18	-
	Thiruppulani	1	65	31	-	-	34	66	-
	Kooraikottam	1	65	31	-	-	34	66	-
	Sethukarai	1	65	31	-	-	34	66	-
	Thathanendal	6	62	29	-	-	37	63	-
	Kudhakottai	5	94	1	-	-	98	1	1
	Utharavai	5	94	1	-	-	98	1	1
	Velanur	68	26	1	1	-	-	28	71
	Melamadai	68	26	1	1	-	-	28	71
	Muthupettai	100	-	-	53	47	-	-	-
	Periyapattinam	100	-	-	53	47	-	-	-
Type 3	Mallai	48	52	-	-	-	-	-	100
	Mayakulam	3	96	1	1	-	1	11	87
	Thillaiyenthal	83	17	-	31	39	10	20	-

S No	Gram Panchayat	Status of Soil Micro Nutrients (%)		Status of Physical condition of the soil (%)			Soil Texture	
Key CWRM Parameter		Sufficient	Deficient	Moderately Acidic	Slighly Acidic	Moderately Alkaline	% of Fine Soil	Soil Water Permeability (Low, Moderate, high)
Type 1	Vellamaruchikatti	61	39	25	29	46	87	Moderate
	Panayadiyenthal	57	43	1	4	95	99	Moderate
	Utrakosamangai	74	26	-	53	47	93	Moderate
	Komboothi	72	28	44	3	53	96	Moderate
	Alangulam	60	40	5	13	83	90	Moderate
	Landai	36	64	1	1	98	51	Moderate
	Ekkakudi	78	22	10	6	84	77	Moderate
	Kalari	51	49	-	-	100	81	Moderate
	Kulapatham	52	48	75	25	-	85	Moderate
	Nallirukai	66	34	8	18	74	96	Moderate
	Panaikulam	67	33	2	-	98	86	Moderate
	Kanjirangudi	31	69	-	-	100	79	Moderate
Type 2	Kalimankundu	36	64	4	-	96	92	Moderate
	Thinaikulam	36	64	4	-	96	69	Moderate
	Methalodai	36	64	4	-	96	81	Moderate
	Raghunathapuram	53	47	3	5	92	94	Moderate
	Nainamarkkam	53	47	3	5	92	81	Moderate
	Vannankundu	67	33	87	13	-	86	Moderate
	Pathiratharavai	67	33	87	13	-	86	Moderate
	Chinnandivalasai	67	33	87	13	-	99	Moderate
	Thiruppulani	64	36	-	1	99	71	Moderate
	Kooraikottam	64	36	-	1	99	74	Moderate
	Sethukarai	64	36	-	1	99	56	Moderate
	Thathanendal	64	36	-	1	99	57	Moderate
	Kudhakottai	65	35	-	22	63	86	Moderate
	Utharavai	65	35	-	22	63	91	Moderate
	Velanur	35	65	-	-	100	93	Moderate
	Melamadai	35	65	-	-	100	93	Moderate
	Muthupettai	51	49	-	-	100	95	Moderate
	Periyapattinam	51	49	-	-	100	93	Moderate
Type 3	Mallai	66	34	85	3	12	84	Moderate
	Mayakulam	57	43	37	-	63	76	Moderate
	Thillaiyenthal	65	35	3	4	93	71	Moderate

S No	Gram Panchayat	Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)	
Key CWRM Parameter		Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding
Type 1	Vellamaruchikatti	17	122	289	73	27	30	70
	Panayadiyenthal	17	196	462	75	25	86	14
	Utrakosamangai	17	150	417	6	94	733	27
	Komboothi	17	104	264	71	29	96	4
	Alangulam	17	119	301	69	31	100	-
	Landai	17	149	283	71	29	100	-
	Ekkakudi	17	64	198	67	33	69	31
	Kalari	17	216	585	83	17	100	-
	Kulapatham	17	100	295	82	18	98	2
	Nallirukai	17	135	414	72	28	34	66
	Panaikulam	17	95	289	73	27	17	83
	Kanjirangudi	17	191	575	64	36	69	31
Type 2	Kalimankundu	17	24	73	70	30	100	-
	Thinaikulam	17	24	73	100	-	100	-
	Methalodai	17	12	37	100	-	100	-
	Raghunathapuram	17	88	270	82	18	100	-
	Nainamarkkam	17	54	166	100	-	100	-
	Vannankundu	17	141	380	82	18	99	1
	Pathiratharavai	17	37	101	100	-	100	-
	Chinnandivalasai	17	29	78	100	-	100	-
	Thiruppulani	17	18	49	100	-	100	-
	Kooraikottam	17	18	49	100	-	100	-
	Sethukarai	17	57	155	100	-	100	-
	Thathanendal	17	206	562	27	73	79	21
	Kudhakottai	17	98	259	30	70	79	21
	Utharavai	17	71	188	30	70	79	21
	Velanur	17	20	62	100	-	100	-
	Melamadai	17	114	350	100	-	100	-
	Muthupettai	17	43	121	64	36	100	-
	Periyapattinam	17	43	121	64	36	83	17
Type 3	Mallai	17	208	567	5	95	24	76
	Mayakulam	17	279	785	67	33	63	37
	Thillaiyenthal	17	266	773	33	67	62	38

S No	Gram Panchayat	Livestock (No.)			
Key CWRM Parameter		Cattle Population	Sheep Population	Goat Population	Poultry
Type 1	Vellamaruchikatti	95	314	435	264
	Panayadiyenthal	92	277	534	750
	Utrakosamangai	232	886	250	276
	Komboothi	58	336	68	95
	Alangulam	548	1,169	1,298	2,415
	Landai	145	565	299	211
	Ekkakudi	56	240	426	139
	Kalari	191	142	488	346
	Kulapatham	147	49	193	82
	Nallirukai	109	1,378	224	70
	Panaikulam	84	1,049	786	328
	Kanjirangudi	282	1,576	1,320	1,779
Type 2	Kalimankundu	136	-	668	1,393
	Thinaikulam	136	-	668	1,393
	Methalodai	68	-	334	696
	Raghunathapuram	401	-	1,229	1,629
	Nainamarkkam	186	-	-	767
	Vannankundu	486	15	855	1,162
	Pathiratharavai	129	4	226	308
	Chinnandivalasai	100	3	176	239
	Thiruppulani	31	33	75	65
	Kooraikottam	31	33	75	65
	Sethukarai	97	105	238	206
	Thathanendal	351	380	864	106
	Kudhakottai	479	-	809	675
	Utharavai	347	-	586	489
	Velanur	40	1,823	245	53
	Melamadai	227	10,330	1,386	53
	Muthupettai	64	25	347	458
	Periyapattinam	64	25	347	458
Type 3	Mallai	275	2,554	689	531
	Mayakulam	401	5	1,953	1,550
	Thillaiyenthal	331	584	1,003	1,832

GP WISE DEMOGRAPHIC AND SOCIO-ECONOMIC STATUS

ANNEXURE 3.11

Key CWRM Parameter	Gram Panchayat	Geographical Area	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	Vulnerable popu-pation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)
Type 1	Vellamaruchikatti	1,195	866	949	1,815	1,176	1,176	469	329
	Panayadiyenthal	1,259	629	628	1,257	1,178	1,178	343	68
	Utrakosamangai	1,149	1,123	1,011	2,134	261	261	556	42
	Komboothi	880	452	434	886	43	43	201	5
	Alangulam	879	705	690	1,395	867	867	373	116
	Landai	1,245	1,235	1,184	2,419	2,112	2,112	658	65
	Ekkakudi	491	1,360	1,269	2,629	610	610	542	26
	Kalari	1,409	720	723	1,443	1,227	1,227	240	33
	Kulapatham	746	957	952	1,909	658	658	470	12
	Nallirukai	1,174	594	622	1,216	440	440	329	152
	Panaikulam	731	378	395	773	370	370	355	177
	Kanjirangudi	1,586	3,791	3,674	7,465	1,071	1,072	1,695	352
Type 2	Kalimankundu	514	2,834	2,874	5,708	94	94	1,525	280
	Thinaikulam	514	2,834	2,874	5,708	94	94	1,525	280
	Methalodai	233	2,834	2,874	5,708	94	94	1,525	280
	Raghunathapuram	768	3,962	3,781	7,743	184	184	1,953	303
	Nainamarkkam	427	3,962	3,781	7,743	184	184	1,953	303
	Vannankundu	1,009	4,028	3,907	7,935	183	183	1,953	303
	Pathiratharavai	252	4,028	3,907	7,935	183	183	1,953	303
	Chinnandivalasai	202	4,028	3,907	7,935	183	183	1,953	303
	Thiruppulani	162	2,921	2,946	5,867	2,124	2,124	1,628	502
	Kooraikottam	169	2,921	2,946	5,867	2,124	2,124	1,628	502
	Sethukarai	612	2,921	2,946	5,867	2,124	2,124	1,628	502
	Thathanendal	2,021	2,921	2,946	5,867	2,124	2,124	1,628	502
	Kudhakottai	742	1,614	1,670	3,284	338	338	797	254
	Utharavai	533	1,614	1,670	3,284	338	338	797	254
	Velanur	140	1,514	1,387	2,901	2,035	2,035	744	73
	Melamadai	912	1,514	1,387	2,901	2,035	2,035	744	73
	Muthupettai	266	689	861	1,550	1	1	1,701	256
	Periyapattinam	557	689	861	1,550	1	1	1,701	256
Type 3	Mallai	1,656	1,545	1,573	3,118	2,072	2,072	359	139
	Mayakulam	2,181	3,968	3,150	7,118	1,169	1,169	1,388	228
	Thillaiyenthal	1,902	4,033	3,438	7,471	2,816	2,816	1,631	295

Key CWRM Parameter	Gram Panchayat	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha.m)
Type 1	Vellamaruchikatti	41	243	52	882	597	94	95	330	3
	Panayadiyenthal	25	55	16	690	496	35	210	490	2
	Utrakosamangai	24	37	7	658	340	115	240	175	4
	Komboothi	4	5	2	363	231	44	280	660	2
	Alangulam	31	91	24	641	361	141	159	209	3
	Landai	37	57	9	872	698	59	240	298	4
	Ekkakudi	134	58	11	431	282	61	307	654	5
	Kalari	25	31	13	746	507	50	140	295	3
	Kulapatham	28	17	4	582	254	68	175	156	3
	Nallirukai	30	115	35	614	407	52	102	209	2
	Panaikulam	26	132	37	454	350	53	105	25	1
	Kanjirangudi	62	265	16	1,265	586	167	130	1,390	14
Type 2	Kalimankundu	117	231	15	1,002	723	484	957	645	10
	Thinaikulam	117	231	15	870	468	479	550	230	10
	Methalodai	117	231	15	470	338	370	445	26	10
	Raghunathapuram	70	233	12	1,347	882	592	625	330	14
	Nainamarkkam	70	233	12	797	472	506	440	28	14
	Vannankundu	70	233	12	983	810	1,213	1,290	58	14
	Pathiratharavai	70	233	12	401	330	78	360	28	14
	Chinnandivalasai	70	233	12	568	398	254	330	400	14
	Thiruppulani	80	375	23	678	189	37	150	245	11
	Kooraikottam	80	375	23	196	110	18	280	265	11
	Sethukarai	80	375	23	438	275	310	411	188	11
	Thathanendal	80	375	23	820	567	86	170	455	11
	Kudhakottai	57	195	24	944	707	356	430	345	6
	Utharavai	57	195	24	412	324	181	78	244	6
	Velanur	61	69	9	548	370	48	189	46	5
	Melamadai	61	69	9	722	534	58	250	42	5
	Muthupettai	54	195	11	524	234	106	160	100	3
	Periyapattinam	54	195	11	524	234	357	160	100	3
Type 3	Mallai	25	105	29	1,351	1,005	307	400	60	6
	Mayakulam	50	175	13	1,296	987	471	650	675	13
	Thillaiyenthal	195	265	16	1,718	1,226	189	2,800	1,550	14

ANNEXURE 4

IPCC VULNERABILITY ASSESSMENT METHODOLOGY

Normalization of Indicators:

In order to make the indicators free from the units, normalization has done. The normalization process varies depending on the nature of relationship of that particular indicator with the vulnerability. The following formula are used,

- for indicators with positive relationship with vulnerability

$$x_{ij}^{P} = \frac{Xij - Min\, i\{Xij\}}{(Max\, i\{Xij\} - Min\, i\{Xij\}}$$

- for indicators with negative relationship with vulnerability

$$x_{ij}^{n} = \frac{Max\, i\{Xij\} - Xij}{Max\, i\{Xij\} - Min\{Xij\}}$$

Aggregation and categorization of Indicators

The normalized values of indicator sets are aggregated to obtain the vulnerability index and categorized in to high, medium and low vulnerability classes.

$$VI = \frac{\sum_{i}^{N} K_i S_i}{K_i}$$

X_{ij} is the value of j^{th} indicator for i^{th} GP and X^{P}_{ij} is the normalized value

X_{ij} is the value of j^{th} indicator for i^{th} GP and x^{n}_{ij} is the normalized value

ANNEXURE 5.1

GP WISE WASCA PROPOSED TREATMENT AREA

GP Name	Treatment Area under Forest Land	Treatment Area under Non-Agricultural Uses	Treatment Area under Barren & Un-cultivable Land	Treatement Area under Permanent Pastures and Other Grazing Land	Treatment Area under Land Under Miscellaneous Tree Crops etc.	Treatment Area under Culturable Waste Land	Treatment Area under Fallows Land other than Current Fallows	Treatment Area under Current Fallow land	Treatment Area under Unirrigated Land	Treatment Area Irrigated by Source
Unit	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
Vellamaruchikatti	_	81.48	_	_	40.56	12.79	61.95	15.21	47.77	215.03
Panayadiyenthal	_	1.82	_	_	239.89	_	5.60	37.09	83.81	12.67
Utrakosamangai	_	7.95	_	_	492.83	_	_	3.24	3.33	5.42
Komboothi	_	23.23	_	_	210.91	_	0.06	2.09	4.21	0.95
Alangulam	_	3.04	_	_	_	_	_	29.70	98.35	39.90
Landai	_	29.13	_	_	_	2.07	_	30.11	23.49	25.33
Ekkakudi	_	2.77	_	_	163.08	0.00	_	_	1.19	19.37
Kalari	_	2.32	_	_	612.19	101.32	2.84	1.60	9.98	41.97
Kulapatham	_	1.61	_	_	150.58	_	0.81	0.07	5.42	10.13
Nallirukai	_	40.04	_	_	305.37	_	_	0.00	95.76	56.30
Panaikulam	_	4.75	_	_	100.14	_	_	2.76	65.68	95.54
Kanjirangudi	_	36.55	_	_	400.46	_	_	2.79	26.95	73.80
Kalimankundu	_	144.35	_	_	14.31	_	_	_	7.13	11.39
Thinaikulam	_	144.35	_	_	14.31	_	_	_	7.13	11.39
Methalodai	_	72.20	_	_	7.15	_	_	_	3.57	5.69
Raghunathapuram	_	29.51	_	_	9.37	_	_	0.01	12.70	48.05
Nainamarkkam	_	18.10	_	_	5.74	_	_	0.01	7.78	29.45
Vannankundu	_	2.83	_	_	31.33	83.16	_	0.40	56.78	26.10
Pathiratharavai	_	0.75	_	_	8.29	22.02	_	0.11	15.02	6.91
Chinnandivalasai	_	0.58	_	_	6.45	17.12	_	0.08	11.69	5.37
Thiruppulani	_	11.96	_	_	36.41	3.78	0.64	1.08	7.72	3.95
Kooraikottam	_	11.96	_	_	36.41	3.78	0.64	1.08	7.72	3.95

GP Name	Treatment Area under Forest Land	Treatment Area under Non-Agricultural Uses	Treatment Area under Barren & Un-cultivable Land	Treatement Area under Permanent Pastures and Other Grazing Land	Treatment Area under Land Under Miscellaneous Tree Crops etc.	Treatment Area under Culturable Waste Land	Treatment Area under Fallows Land other than Current Fallows	Treatment Area under Current Fallow land	Treatment Area under Unirrigated Land	Treatment Area Irrigated by Source
Unit	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
Sethukarai	_	37.86	_	_	115.31	11.96	2.01	3.42	24.44	12.50
Thathanendal	_	137.51	_	_	418.77	43.43	7.31	12.42	88.77	45.38
Kudhakottai	_	4.32	_	_	125.98	22.23	0.77	11.49	41.71	41.95
Utharavai	_	3.13	_	_	91.23	16.10	0.56	8.32	30.20	30.37
Velanur	_	3.04	_	_	5.87	0.13	_		7.52	2.50
Melamadai	_	17.24	_	_	33.24	0.72	_		56.83	18.92
Muthupettai	_	0.21	_	_	41.14	_	_	2.42	20.13	0.00
Periyapattinam	_	0.21	_	_	41.14	_	_	2.42	20.13	0.00
Mallai	_	12.39	_	_	187.66	_	_	41.21	125.97	133.48
Mayakulam	_	6.72	_	_	555.70	_	3.73	13.97	65.86	44.69
Thillaiyenthal	_	58.43	_	_	340.87	_	3.95	9.19	101.13	71.65

Land Resources - WASCA Treatment Proposed Area	logic
Treatment Area under Forest Land	40% of the total Area (area after removal of potential voids)
Treatment Area under Non-Agricultural Uses	Identifying Additional Area available for recharge & plantation(if area is above 20 %: consider all the additional area for treatment(ex 24.86 %, 4.86 % is proposed): if the % area is between 15-20 % only, consider 50 % of additional area)
Treatment Area under Barren & Un-cultivable Land	75% of the total Area (area after removal of potential voids)
Treatment Area under Permanent Pastures and Other Grazing Land	75% of the total Area (potential area for treatment after removal of voids)
Treatment Area under Land Under Miscellaneous Tree Crops etc.	75% of the total Area (non- voids area)
Treatment Area under Cultivable Waste Land	75% of the total Area (non- voids area)
Treatment Area under Fallows Land other than Current Fallows	Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF
Treatment Area under Current Fallow land	Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF
Treatment Area under Unirrigated Land	Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF
Treatment Area Irrigated by Source	Bore Well Farmer Factor arrived as per Vulnerability Assessment in Table 1 and out of which 50% is for horticulture or AF

ANNEXURE 5.2

GP WISE EXPECTED RUNOFF CONSERVATION AFTER WASCA TREATMENT

GP name	Good Catchment Area ha.m	Average Catchment Area ha.m	Bad Catchment Area ha.m
Vellamaruchikatti	40.73	8.56	39.63
Panayadiyenthal	17.95	36.78	16.22
Utrakosamangai	19.73	80.45	1.40
Komboothi	12.58	35.24	0.85
Alangulam	14.28	0.00	19.58
Landai	28.23	0.00	9.20
Ekkakudi	0.98	27.89	2.40
Kalari	17.19	112.89	6.57
Kulapatham	18.23	26.23	1.92
Nallirukai	28.00	57.63	17.73
Panaikulam	27.89	18.25	19.12
Kanjirangudi	37.31	75.23	12.15
Kalimankundu	40.48	2.50	2.16
Thinaikulam	39.39	2.50	2.16
Methalodai	22.53	1.25	1.08
Raghunathapuram	32.27	1.64	7.08
Nainamarkkam	5.40	1.00	4.34
Vannankundu	8.29	20.02	9.71
Pathiratharavai	2.85	5.30	2.57
Chinnandivalasai	1.28	4.12	2.00
Thiruppulani	12.82	7.03	1.56
Kooraikottam	10.26	7.03	1.56
Sethukarai	26.21	22.26	4.94
Thathanendal	37.36	80.83	17.94
Kudhakottai	3.98	25.92	11.18
Utharavai	13.63	18.77	8.10
Velanur	4.76	1.05	1.17
Melamadai	12.00	5.94	8.83
Muthupettai	1.56	6.25	2.63
Periyapattinam	1.98	6.25	2.63
Mallai	44.19	5.85	0.00
Mayakulam	8.64	97.83	95.04
Thillaiyenthal	94.56	1.87	0.00

ANNEXURE 5.3

GP-WISE PROPOSED WORKS BASED ON WATERSHED AND LIVELIHOOD APPROACH (area in ha / length in m)

Gram Panchayat	Aff		ARS	AVP		AZ	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	No.	Area	No.	Area	No.
Alangulam	2,433	3	66	1,052	4,207	14	-	-	809	3,236	14
Chinnandivalasai	466	1	-	803	3,210	3	18,856	24	-	-	3
Ekkakudi	2,217	3	-	1,623	6,490	1	32,616	163	800	3,200	1
Kalari	1,855	2	129	1,249	4,995	5	570,806	714	302	1,209	5
Kalimankundu	115,479	144	-	350	1,399	3	11,444	14	-	-	3
Kanjirangudi	29,237	37	-	-	-	7	320,368	400	-	-	7
Komboothi	18,580	23	19	-	-	1	168,728	211	-	-	1
Kooraikottam	9,566	12	-	190	758	1	32,153	40	-	-	1
Kudhakottai	3,456	4	19	1,277	5,106	12	118,570	148	155	621	12
Kulapatham	1,287	2	101	-	-	4	120,462	151	1,149	4,596	4
Landai	23,302	29	134	1,623	6,490	4	1,659	2	1,080	4,320	4
Mallal	9,916	12	55	1,288	5,150	7	37,533	188	-	-	7
Mayakulam	5,373	7	26	2,407	9,627	10	444,557	556	885	3,538	10
Melamadai	13,792	17	-	1,740	6,958	6	27,166	34	1,958	7,830	6
Methalodai	57,763	72	-	886	3,544	2	5,723	7	-	-	2
Muthupettai	167	0	65	520	2,078	2	32,912	41	-	-	2
Nainamarkkam	14,477	18	-	1,853	7,413	5	4,594	6	-	-	5
Nallirukai	32,033	40	64	-	-	3	244,297	305	1,100	4,400	3
Panaikulam	3,798	5	103	-	-	2	80,111	100	1,100	4,400	2
Panayadiyenthal	1,457	2	32	705	2,820	2	191,910	240	435	1,740	2
Pathiratharavai	600	1	-	697	2,786	3	24,247	30	-	-	3
Periyapattinam	167	0	35	801	3,204	2	32,912	41	-	-	2
Raghunathapuram	23,607	30	-	1,612	6,447	10	7,494	9	-	-	10
Sethukarai	30,292	38	-	875	3,501	2	101,816	127	1,328	5,312	2
Thathanendal	110,007	138	22	3,613	14,453	9	369,760	462	927	3,708	9
Thillaiyenthal	46,746	58	53	-	-	8	68,173	341	-	-	8
Thinaikulam	115,479	144	-	667	2,669	3	11,444	14	-	-	3
Thiruppulani	9,566	12	-	938	3,750	1	32,153	40	112	447	1
Utharavai	2,502	3	14	602	2,407	9	85,865	107	109	435	9
Utrakosamangai	6,359	8	54	1,457	5,826	6	394,264	493	1,292	5,169	6
Vannankundu	2,265	3	1	3,384	13,536	12	91,598	115	-	-	12
Velanur	2,434	3	-	184	736	1	4,794	6	-	-	1
Vellamaruchikatti	65,181	81	165	880	3,521	2	42,684	53	557	2,229	2

Gram Panchayat	CT	CO		FP		CCB		DLT		DHAFI	
	No.	No.	Area	No.	Area	No.	Length	No.	Length	No.	Area
Alangulam	14	51	168	51	168	608	3	-	-	34	84
Chinnandivalasai	3	5	17	5	17	117	1	-	-	3	9
Ekkakudi	1	-	21	-	21	554	3	354	1,414	4	10
Kalari	5	6	56	6	56	464	2	1,499	5,994	11	28
Kalimankundu	3	3	19	3	19	28,870	144	-	-	4	9
Kanjirangudi	7	12	104	12	104	7,309	37	-	-	21	52
Komboothi	1	3	7	3	7	4,645	23	-	-	1	4
Kooraikottam	1	4	13	4	13	2,391	12	62	246	3	7
Kudhakottai	12	22	96	22	96	864	4	-	-	19	48
Kulapatham	4	3	16	3	16	322	2	114	456	3	8
Landai	4	21	79	21	79	5,825	29	953	3,810	16	39
Mallal	7	67	301	67	301	2,479	12	3,152	12,606	60	150
Mayakulam	10	33	128	33	128	1,343	7	-	-	26	64
Melamadai	6	23	76	23	76	3,448	17	-	-	15	38
Methalodai	2	1	9	1	9	14,441	72	-	-	2	5
Muthupettai	2	9	23	9	23	42	0	101	403	5	11
Nainamarkkam	5	3	37	3	37	3,619	18	-	-	7	19
Nallirukai	3	38	152	38	152	8,008	40	1,134	4,537	30	76
Panaikulam	2	27	164	27	164	950	5	1,134	4,537	33	82
Panayadiyenthal	2	51	139	51	139	364	2	-	-	28	70
Pathiratharavai	3	6	22	6	22	150	1	-	-	4	11
Periyapattinam	2	9	23	9	23	42	0	-	-	5	11
Raghunathapuram	10	5	61	5	61	5,902	30	-	-	12	30
Sethukarai	2	12	42	12	42	7,573	38	-	-	8	21
Thathanendal	9	43	154	43	154	27,502	138	2,126	8,503	31	77
Thillaiyenthal	8	46	186	46	186	11,686	58	2,123	8,493	37	93
Thinaikulam	3	3	19	3	19	28,870	144	-	-	4	9
Thiruppulani	1	4	13	4	13	2,391	12	-	-	3	7
Utharavai	9	16	69	16	69	626	3	-	-	14	35
Utrakosamangai	6	3	12	3	12	1,590	8	149	596	2	6
Vannankundu	12	23	83	23	83	566	3	-	-	17	42
Velanur	1	3	10	3	10	609	3	-	-	2	5
Vellamaruchikatti	2	50	340	50	340	16,295	81	1,162	4,647	68	170

Gram Panchayat	FBBT		FD	GSS	ICP		LDI		LP		MI	
	No.	Area	No.	No.	No.	Length	No.	Area	No.	Length	No.	Area
Alangulam	67	168	14	19	393	1,571	26	64	250	1,000	16	40
Chinnandivalasai	7	17	3	18	-	-	2	6	125	500	2	5
Ekkakudi	8	21	1	5	1,000	4,000	-	1	500	2,000	8	19
Kalari	23	56	5	6	403	1,610	3	7	400	1,600	17	42
Kalimankundu	7	19	3	67	-	-	1	4	200	800	5	11
Kanjirangudi	42	104	7	21	-	-	6	15	325	1,300	30	74
Komboothi	3	7	1	2	-	-	1	3	125	500	-	1
Kooraikottam	5	13	1	8	-	-	2	5	409	1,634	2	4
Kudhakottai	38	96	12	81	146	584	11	27	275	1,100	17	42
Kulapatham	7	16	4	2	266	1,063	1	3	350	1,400	4	10
Landai	32	79	4	6	300	1,199	11	27	550	2,200	10	25
Mallal	120	301	7	7	-	-	33	84	450	1,800	53	133
Mayakulam	51	128	10	195	200	799	17	42	400	1,600	18	45
Melamadai	30	76	6	397	562	2,248	11	28	225	900	8	19
Methalodai	4	9	2	33	-	-	1	2	250	1,000	2	6
Muthupettai	9	23	2	4	-	-	5	11	175	700	-	-
Nainamarkkam	15	37	5	-	-	-	2	4	687	2,746	12	29
Nallirukai	61	152	3	9	554	2,214	19	48	350	1,400	23	56
Panaikulam	66	164	2	13	554	2,214	14	34	450	1,800	38	96
Panayadiyenthal	56	139	2	7	159	635	25	63	475	1,900	5	13
Pathiratharavai	9	22	3	23	137	547	3	8	375	1,500	3	7
Periyapattinam	9	23	2	4	-	-	5	11	1,038	4,150	-	-
Raghunathapuram	24	61	10	123	-	-	3	6	775	3,100	19	48
Sethukarai	17	42	2	26	-	-	6	15	568	2,272	5	13
Thathanendal	62	154	9	96	91	364	22	54	584	2,335	18	45
Thillaiyenthal	74	186	8	8	-	-	23	57	600	2,400	29	72
Thinaikulam	7	19	3	67	-	-	1	4	175	700	5	11
Thiruppulani	5	13	1	8	-	-	2	5	406	1,624	2	4
Utharavai	28	69	9	59	91	363	8	20	550	2,200	12	30
Utrakosamangai	5	12	6	7	651	2,604	1	3	300	1,200	2	5
Vannankundu	33	83	12	86	-	-	11	29	1,241	4,964	10	26
Velanur	4	10	1	70	99	395	2	4	125	500	1	3
Vellamaruchikatti	136	340	2	6	292	1,166	25	62	675	2,700	86	215

Gram Panchayat	NADEP	ND		PS		RWBT	RWBO	RWBP	RRWH	SP	SPI	Tanka	WCIC
	No.	No.	Area	No.	Area	No.	No.	No.	No.	No.	No.	No.	No.
Alangulam	14	1,880	376	12	121	2	8	-	2	4	38	-	1,571
Chinnandivalasai	3	9,630	1,926	6	60		5		2	19	193	-	-
Ekkakudi	1	3,000	600	1	7	3	8	-	2	6	60	-	4,000
Kalari	5	1,935	387	2	17	2	14	-	2	4	39	-	1,610
Kalimankundu	3	7,595	1,519	35	348		8		2	15	152	-	-
Kanjirangudi	7	8,090	1,618	9	89	1	12	-	2	16	162	-	-
Komboothi	1	1,025	205	-	5	1	4	-	2	2	21	-	-
Kooraikottam	1	7,105	1,421	2	16		3		2	14	142	-	-
Kudhakottai	12	3,935	787	17	169		11		2	8	79	-	584
Kulapatham	4	2,035	407	-	4	4	10	-	2	4	41	-	1,063
Landai	4	3,145	629	1	11	8	32	-	2	6	63	-	1,199
Mallal	7	4,215	843	13	133				2	8	84	-	-
Mayakulam	10	35,590	7,118	39	388	3	13	-	2	71	712	-	799
Melamadai	6	3,715	743	1	13		9		2	7	74	-	2,248
Methalodai	2	7,595	1,519	17	174		10		2	15	152	-	-
Muthupettai	2	1,785	357	2	23		6		2	4	36	-	-
Nainamarkkam	5	9,475	1,895	19	192		10		2	19	190	-	-
Nallirukai	3	1,580	316	-	4	2	12	-	2	3	32	-	2,214
Panaikulam	2	1,015	203	2	16	9	9	-	2	2	20	-	2,214
Panayadiyenthal	2	1,705	341	4	38	8	11	-	2	3	34	-	635
Pathiratharavai	3	9,630	1,926	8	77		5		2	19	193	-	547
Periyapattinam	2	1,785	357	2	23		9		2	4	36	-	-
Raghunathapuram	10	9,475	1,895	41	407		21		2	19	190	-	-
Sethukarai	2	7,105	1,421	5	52		6		2	14	142	-	-
Thathanendal	9	7,105	1,421	19	187		10		2	14	142	-	364
Thillaiyenthal	8	8,820	1,764	46	458	8	16	-	2	18	176	1	-
Thinaikulam	3	7,595	1,519	35	348		7		2	15	152	-	-
Thiruppulani	1	7,105	1,421	2	16		5		2	14	142	-	-
Utharavai	9	3,935	787	12	122		22		2	8	79	-	363
Utrakosamangai	6	2,700	540	1	14	1	11	-	2	5	54	-	2,604
Vannankundu	12	9,630	1,926	29	291		31		2	19	193	-	-
Velanur	1	3,715	743	1	13		5		2	7	74	-	395
Vellamaruchikatti	2	2,460	492	1	14	9	18	-	2	5	49	-	1,166

Theme	Work	Abbrivation	No.	Extent
Green	Afforestation in Public/common lands (ha)	Aff	761859	952
	Avenue plantation (m)	AVP	33276	133081
	Block Plantation (Community) (ha)	BP	3731669	5183
	Canal Bund Plantation(ha)	CBP	14098	56390
	Dry land Horticulture/Agro-forestry - Individual (ha)	DHAFL	532	1330
	Irrigation Channel Plantation (m)	ICP	5898	23576
	Linear Plantation (m)	LP	14381	57525
	Nursery Development (No.)	ND	197110	39422
Land Develpment	Contour Continous Bunds for Afforestaion area (m)	CCB	190465	952
	Farm Bunding with Boundary Trenches - Individual (ha)	FBBT	1064	2660
	Land development - Individual (ha)	LD	303	755
Livlihood	Azolla units - Individual (No.)	AZIND	162	-
	Cattle Shelters (No.)	CSN	162	-
	Cattle Trough (No.)	CT	162	-
	Composting (No.)	CO	605	2660
	Drainage Line Treatment (m)	DLT	14063	56242
	Fodder development - Community & Individual	FD	-	1608
	Goat Sheep Shelters (No.)	GSS	-	17150
	Micro Irrigation (ha)	MI	462	1150
	NADEP Vermi compost (No.)	NADEP	-	1608
	Poultry Shed (No.)	PS	384	3850
	Soak Pits (Community) (No.)	SP	391	-
	Soak Pits (Individual) (No.)	SPI	3946	-
Water	Artificial Recharge Structure (No.)	ARS	1157	-
	Construction of Farm Ponds - Individual (No.)	FP	605	-
	Restotaration of water bodies:a.PWD and Tanks (Number)	RWBT	62	-
	Restotaration of water bodies:b. Ooranis (Number)	RWBO	361	-
	Restotaration of water bodies:c. Ponds (Number)	RWBP	-	-
	Roof Rain Water harvesting (No.)	RRWH	66	-
	Tanka - community level (No.)	T	1	-
	Water Course - Irrigation Channels - Desilting (m)	WCIC	23576	-

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

Name of the GP	WASCA Recommendation for 3 Years	Works uploaded for FY-2021-22 as on 02/02/2022
Alangulam	1,016	115
Chinnandivalasai	2,450	292
Ekkakudi	1,283	-
Kalari	1,746	-
Kalimankundu	1,953	240
Kanjirangudi	2,378	-
Komboothi	521	113
Koraikuttam	1,634	-
Kulapatham	1,501	168
Kuthakkottai	2,317	-
Lanthai	1,920	-
Mallal	3,079	285
Mayakulam	4,641	-
Melamadai	1,968	-
Methalodai	1,697	85
Muthupettai	549	-
Nainamaraikkan	2,272	165
Nallirukkai	1,078	-
Panaikkulam	1,166	-
Panaiyadiyenthal	1,087	185
Pathiratharavai	2,212	191
Periyapattinam	1,532	-
Regunathapuram	5,069	-
Sethukarai	1,980	-
Thathanenthal	2,592	-
Thillaiyenthal	4,834	-
Thinaikkulam	2,549	-
Thiruppullani	1,904	102
Thiru uthirakosamangai	1,289	137
Utharavai	2,037	185
Vannankundu	2,522	-
Velanur	879	180
Vellamarichukkatti	1,852	-

ANNEXURE 7.2

GPS AND WORK CATEGORIES WISE ONGOING WORKS COUNTS IN ANAKAVOOR BLOCK

Name of the GP	Work Category	No. of Ongoing works
ALANGULAM	WCWH	1
CINNANDIVALASAI	Works on Individuals Land (Category IV)	12
EKKAKUDI	Rural Connectivity	1
	WCWH	1
KALARI	WCWH	2
	KALIMANKUNDU	2
KANJIRANGUDI	WCWH	2
KOMPOOTHI	WCWH	1
	KORAIKUTTAM	1
KULAPATHAM	WCWH	1
KUTHAKKOTTAI	WCWH	2
LANDHAI	Rural Connectivity	1
	WCWH	2
MALLAL	WCWH	2
	MAYAKULAM	2
MELAMADAI	WCWH	2
METHALODAI	WCWH	1
MUTHUPETTAI	WCWH	1
NAINAMARAIKKAN	WCWH	2
NALLIRUKKAI	WCWH	1
PANAIKKULAM	Rural Connectivity	1
	WCWH	1
PANAIYADIYENTHAL	WCWH	1
	PATHIRATHARAVAI	2
PERIYAPATTINAM	WCWH	1
REGUNATHAPURAM	WCWH	2
SETHUKARAI	WCWH	1
THATHANENTHAL	WCWH	2
THILLAIYENTHAL	WCWH	1
THINAIKKULAM	WCWH	1
THIRU UTHIRAKOSAMANGAI	WCWH	1
THIRUPPULLANI	WCWH	1
UTHARAVAI	WCWH	1
	VANNANKUNDU	1
	WCWH	2
VELANUR	Rural Connectivity	2
	WCWH	1
VELLAMARICHUKKATTI	WCWH	2

ANNEXURE 8

KEY CWRM PARAMETERS OF GPS IN VIVEKANANDHAPURAM MICRO-WATERSHED

Sl.No	Description	GPs in Vivekanandhapuram Micro-watershed
		Mayakulam
Soil Resources: Status of Available Nitrogen in %		
1	Very Low	3
2	Low	96
2	Medium	1
Status of Organic Carbon in %		
3	Very High	87
4	High	11
5	Medium	1
	Very Low	1
Status of Soil Micro Nutrients in %		
6	Sufficient	57
7	Deficient	43
Status of Physical condition of the soil in %		
8	Moderately Alkaline	63
9	Moderately Acidic	37
Soil Texture in %		
10	% of Fine Soil	76
11	Soil Water Permeability (Low, Moderate, high)	Moderate
Means of Water Extraction in %		
13	Gravity	67
14	Lifting	33
Irrigation Methods in %		
15	Wild Flooding	63
16	Control Flooding	37
Livestock		
17	Cattle Population	63
18	Sheep Population	37
19	Goat Population	63
	Poultry	37
Land Resources (in ha)		
20	Land Under Miscellaneous Tree Criticalops etc.	555.7
21	Unirrigated Land	65.86
22	Treatment Area Irrigated by Source	44.69
23	Current Fallow land	13.97
24	Non-Agricultural Uses	6.72
25	Fallows Land other than Current Fallows	3.73

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