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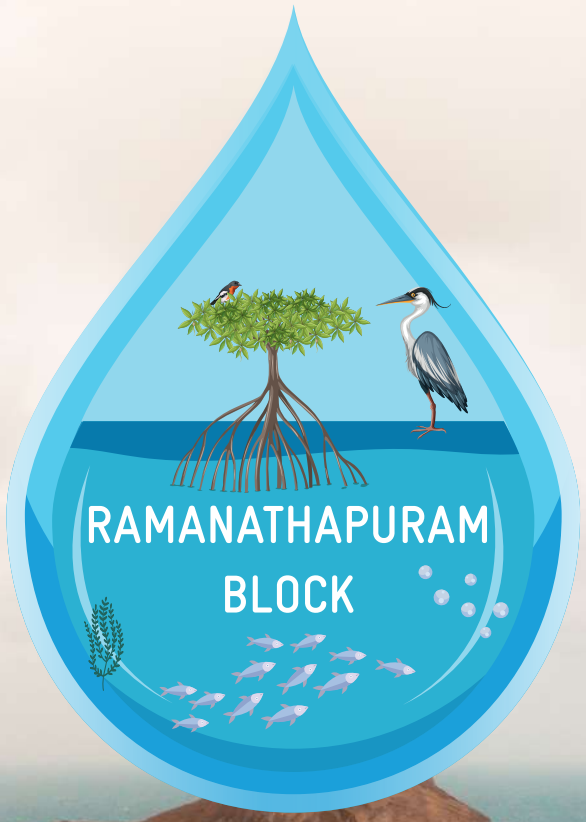
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



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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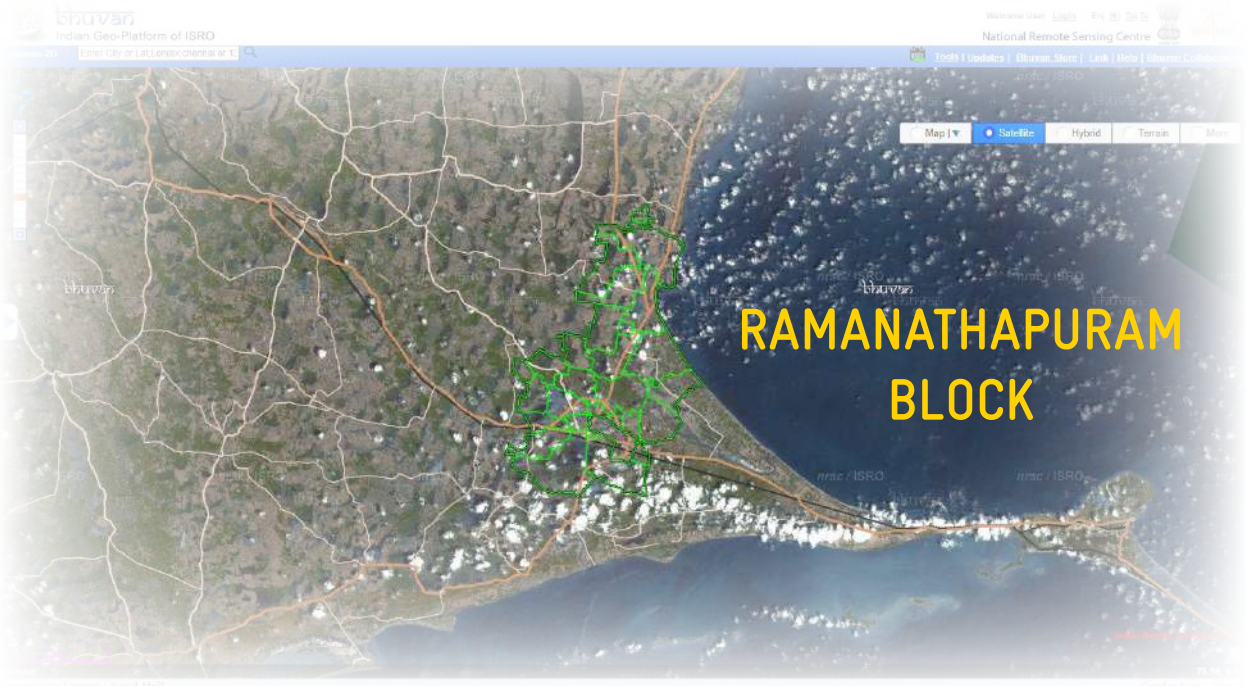
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



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.

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

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.

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
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 Comprehensive Water Resources Management (CWRMP) framework is adopted along with Bhuvan NRSC 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 - G

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

H - K

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

Kharif crop
Sown in Monsoon and harvested close to Autumn

km
Kilometer

KML
Keyhole Markup Language

L - M

LULC
Land use and land cover

Max
Maximum

MCM
Million Cubic Meter

MC
Mid Century

Mahatma Gandhi NREGA
Mahatma Gandhi Rural Employment Guarantee Act

Mahatma Gandhi NRGES
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

N - P

NAPCC
National Action on Climate Change

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

R - S

Rabi crop
Sown in winter and harvested in monsoon

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

S - W

SHG
Self Help Group

SLSC
State Level Steering Committee

ST
Scheduled Tribe

SWM
South-West monsoon

SW
Surface Water

TN
Tamil Nadu

UN
United Nations

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

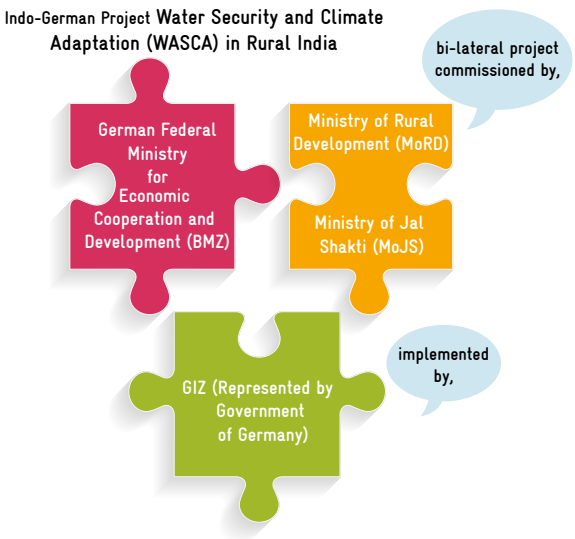
Thirukkural - 11

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 partnership 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 cooperation 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.



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 integrated water resource management (IWRM) principles, the project WASCA aims to significantly contribute towards Sustainable Development Goals for ensuring efficient, sustainable, and inclusive water outcomes. Implementation 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 objective of promoting basin level IWRM. It also explored possible contributions towards the larger goals of Nationally Determined Contribution's (NDC) of climate adaptation through its work on improving water efficiency in agriculture and allied sectors and ecosystem development. The State and District Steering Committee approved the process during May 2020 and the whole progress was jointly accomplished with research organizations and key sectoral experts in February 2021.

Subsequently, the District Collector, Tiruvannamalai, entrusted preparing Block level reports of water security and climate 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

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

2

The 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

The 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

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

5

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

6

The 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

7

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

8

The Eight chapter provides model case study on one micro-watershed 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

The 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

Ramanathapuram is one of the coastal Blocks of Ramanathapuram District which lies between 9°17'36.278"N to 9°33'48.526"N latitude and 78°45'29.076"E to 78°56'7.247"E longitude. This Block has long coastal stretch in East side along the Bay of Bengal and surrounded by Mandapam, Thiruppullani, Bogalur, Nainarkoil and R S Mangalam Blocks (Figure 1.1). The total geographical area of Block is 31,324 ha (313.24 Km^2). Administratively, this Block comes under Ramanathapuram taluk, and it has 25 Gram Panchayats with 146 hamlets.

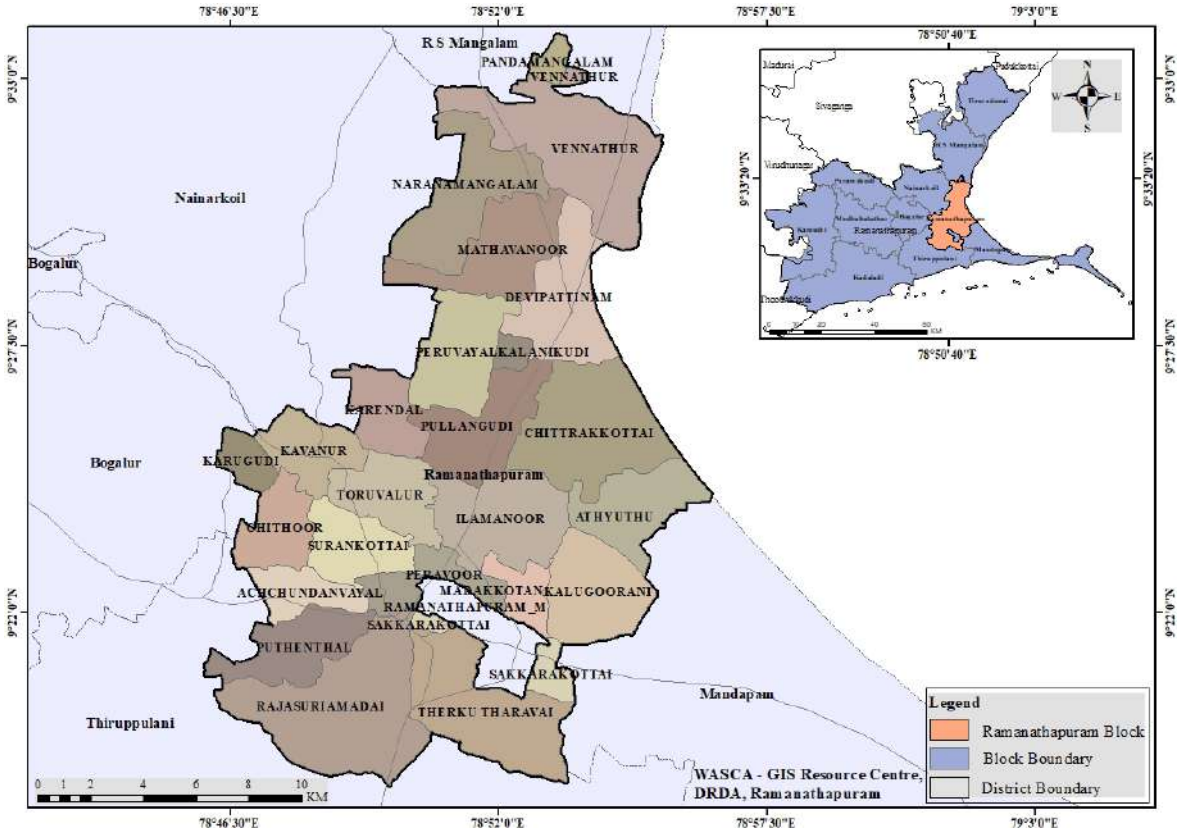


Figure 1.1. Ramanathapuram Block and it's environ

According to Census 2011, the population of the Block is 1,45,452. The population density of the Block is 504 per Km^2 which is much higher than the district (331 Km^2) and lesser than the State's density (555 Km^2). The population growth has increased in the last decade with an increase of 10.68% in population, observed since 2001. The proportion of sex ratio is 988 females for 1000 males. The average literacy rate of this Block is 86.91 % which is much higher than the national average (72.98%). The male literacy rate is high (91.60%) than female literacy rate (82.19%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 17.03% of the total population.

Economically, this coastal 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, 20.78% families are in below poverty line (BPL). The % of BPL families are low in this Block and lesser 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. Cultivation in the Block is both irrigated and rainfed. Paddy is the major crop, and other major

> The proportion of sex ratio is 988 females for 1000 males.

> The average literacy rate of this Block is 86.91 % which is much higher than the national average (72.98%).

crops under irrigation are coconut, oil palm, sesame and dry chilli. Paddy is cultivated both under rainfed and irrigated conditions. Other major cultivation under rainfed conditions is dry chilly, sesame and groundnut. Dairying, sheep rearing and poultry is also visible with 3 milk societies and 21lakh liters of milk being produced in the Block.

> Fishing is a major livelihood of this Block, giving huge profits for the Block and district.

Hydrologically, Ramanathapuram Block comes under Lower Vaigai and Kottakkaraiyar sub-basin of Vaigai and Pambar Kottakkaraiyar basin (Figure 1.2). Situated in rain shadow area, Ramanathapuram district had the extraordinary tank irrigation system which was built hundreds of years ago.

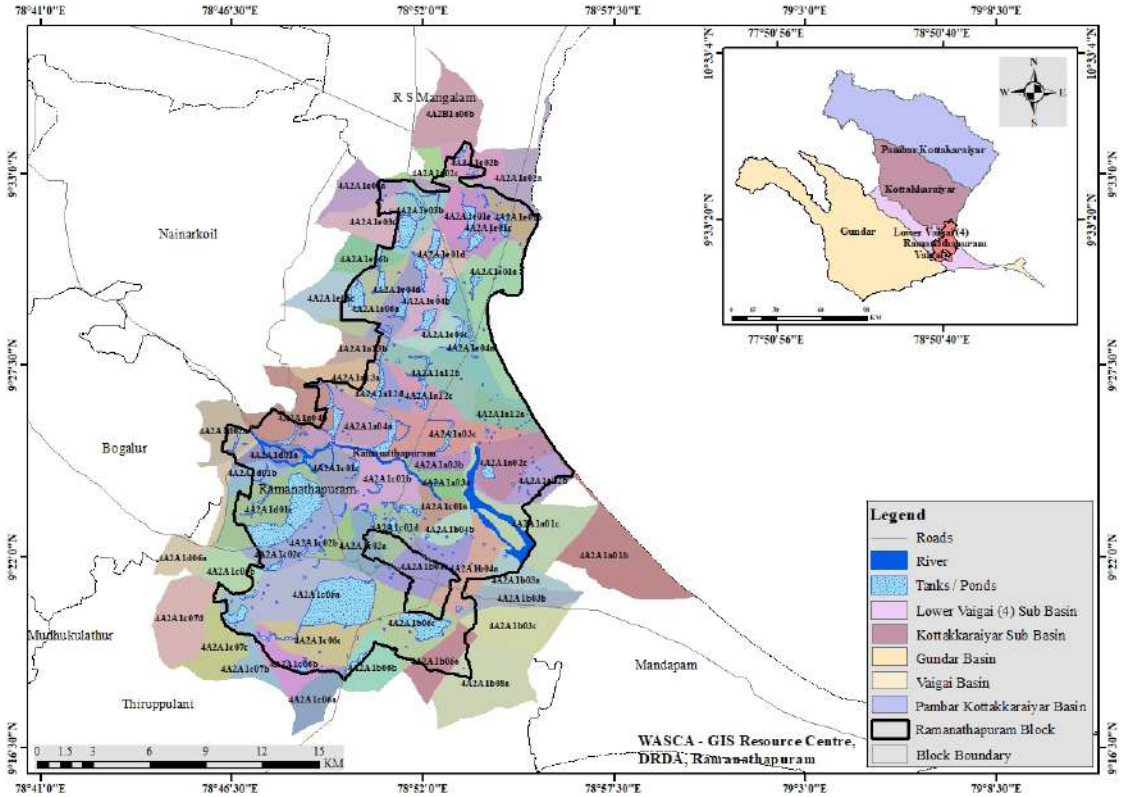


Figure 1.2. Watersheds – Ramanathapuram Block

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 81 major and minor tanks in this Block, 5 Ex zamin MI tanks, 42 Panchayat MI tanks, and 34 PWD tanks (Human Development Report 2017). Figure 1.3 shows the spatial distribution of water bodies in this Block. Four firkas namely Ramanathapuram, Perungulam, Devipattinam and Mandapam cover the Block, all are safe in ground water development.

GROUND WATER LEVEL OF THIS BLOCK

SAFE - <70%	Ramanathapuram, Perungulam, Devipattinam, Mandapam

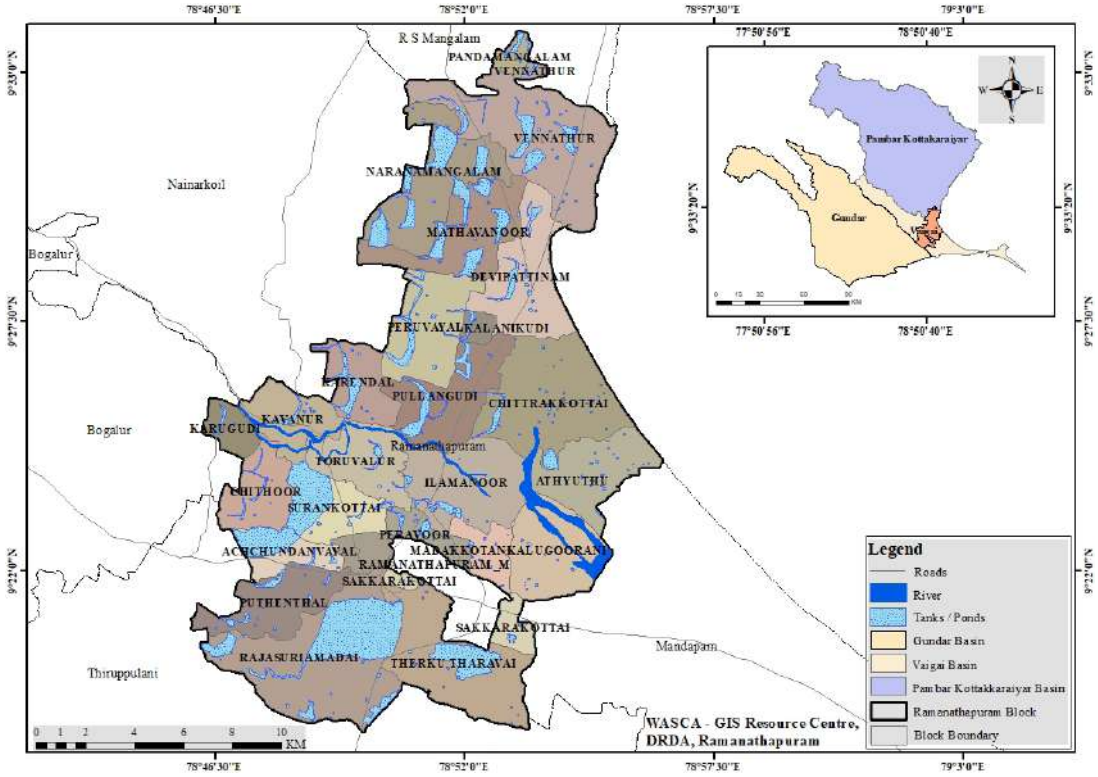
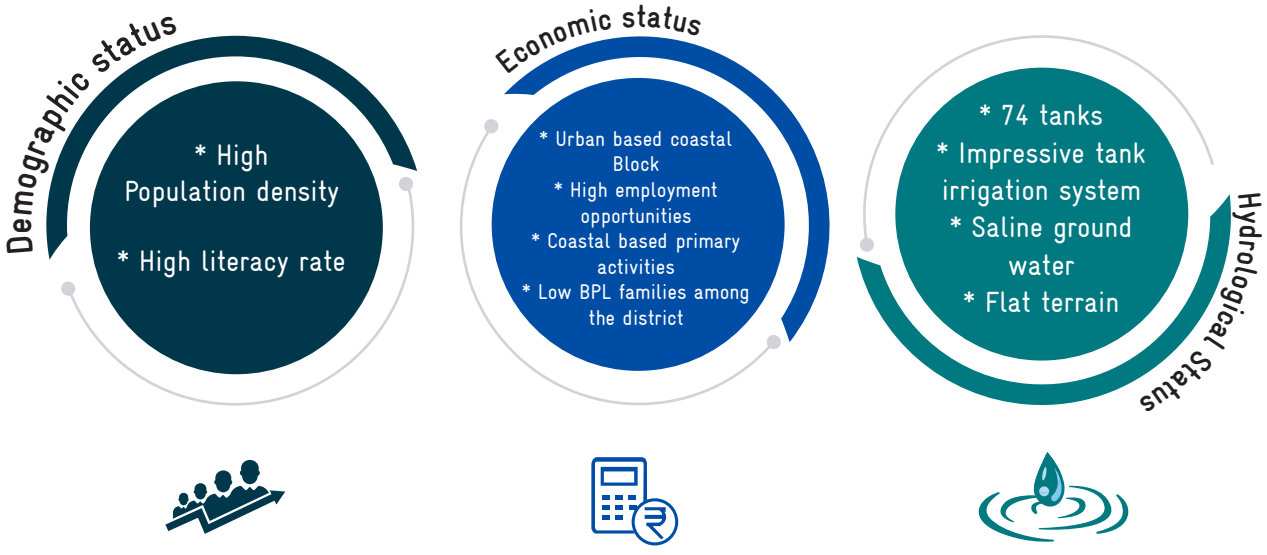


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

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

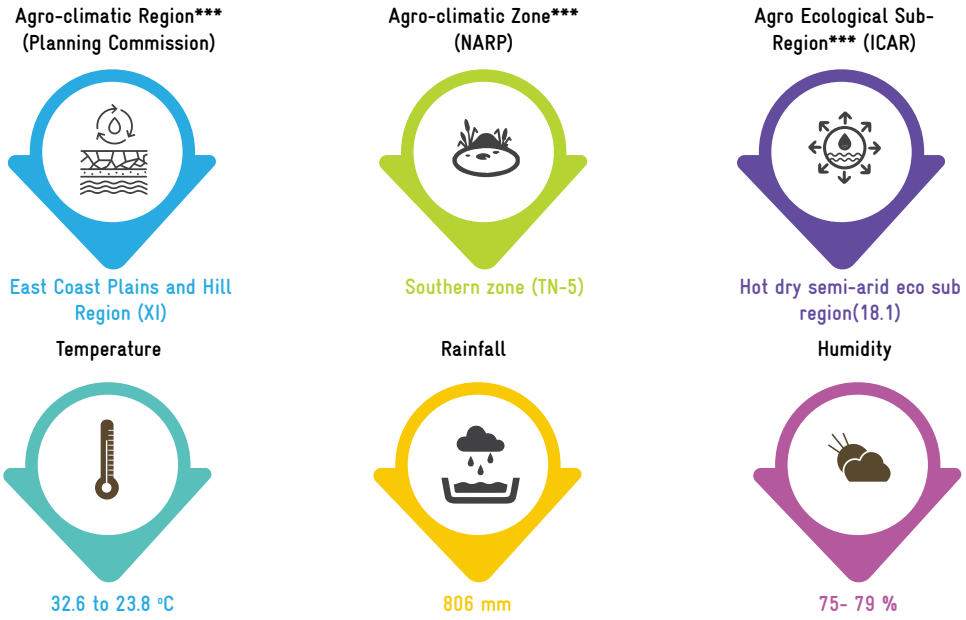
Thirukkural - 13

CHAPTER 2

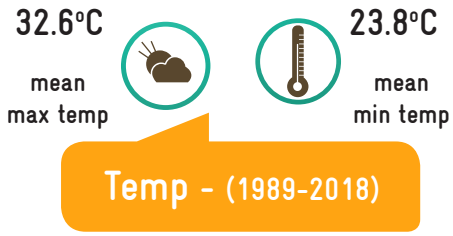
2 CLIMATE AND WATER SECURITY

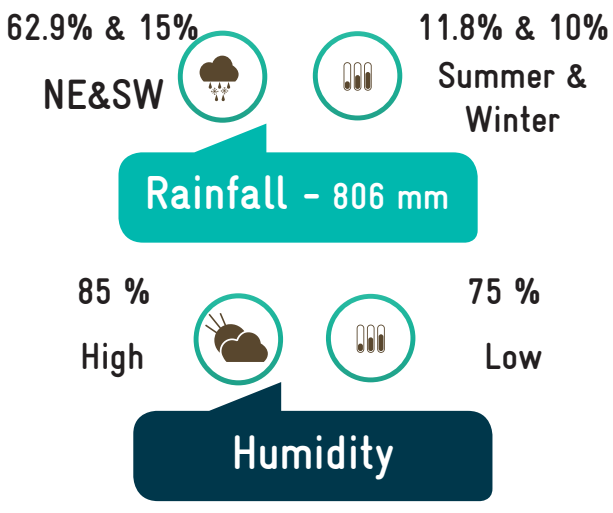
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of planning commission. The general climate description of this region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

TABLE 1. GENERAL CLIMATE DESCRIPTION



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 for the last 30 years (1989-2018) (IMD). In summer months the maximum temperature goes up to 45oC for a few days. The monthly average temperature characteristic during June 2018 to May 2019 is shown in Figure 2.1.





The annual rainfall of this region is 806 mm (IMD) which is less than the 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), and during winter and summer months. NEM contributes a maximum of 62.9% (507.4 mm) of the total annual rainfall and SWM contributes 15% (121.7 mm). This region normally receives rainfall during summer (March to May) and winter (January, February) months also. Summer rainfall accounts for 11.8% (95.5 mm) and winter season accounts for 10% (82.2 mm) of the annual rainfall

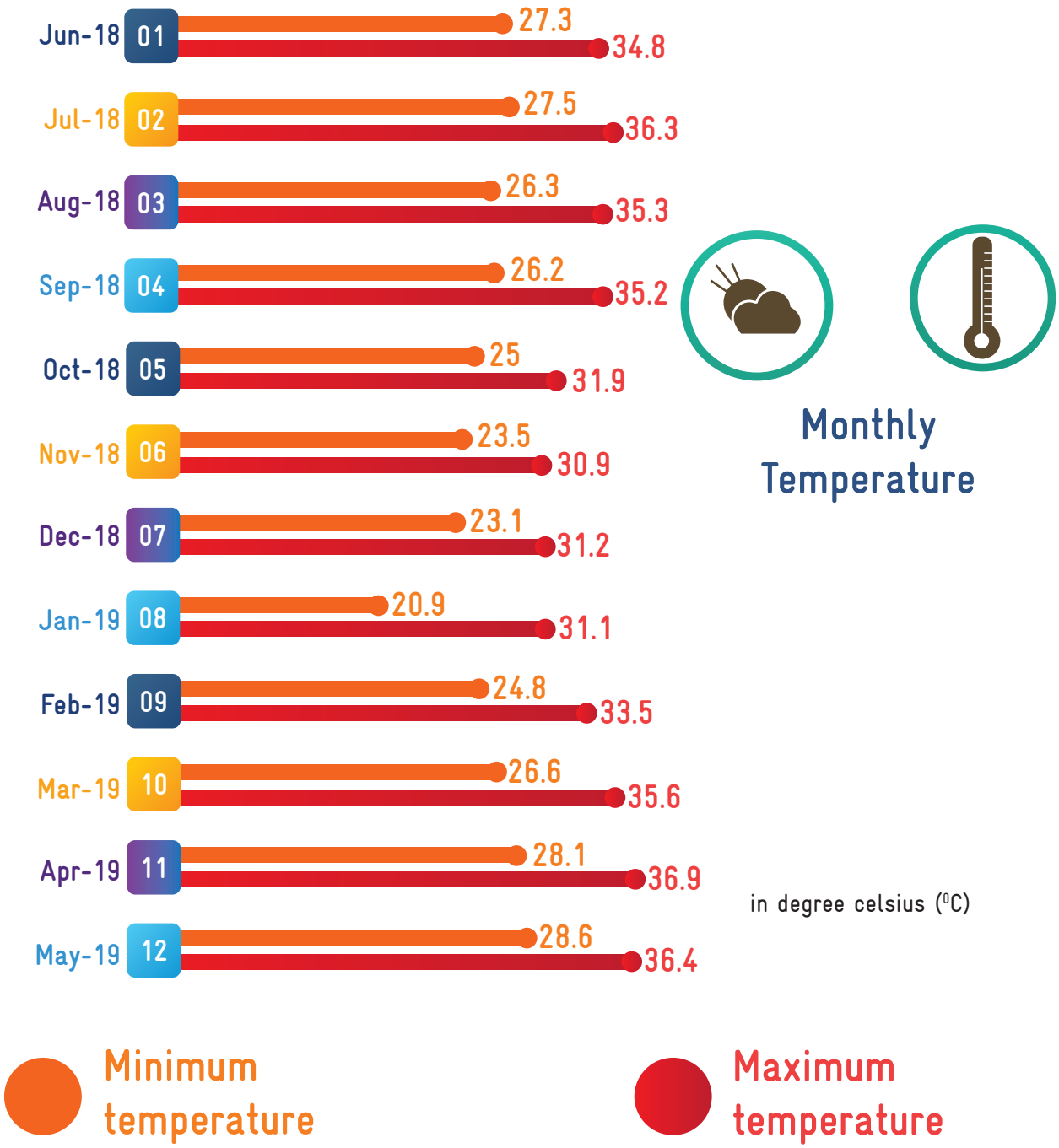


Figure 2.1. Monthly average maximum and minimum temperature

(WRIS, 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 of 10 days followed by 9 days in SWM and 4 days in winter months. The onset of NEM rainfall starts in the first week of October and ceases during the fourth week of December. In general, the humidity percentage ranges between 75% to 79%. The highest relative humidity percentage of 85% is recorded during the month of November and the lowest relative humidity percentage of 75% is recorded during the month of May in this southern zone.

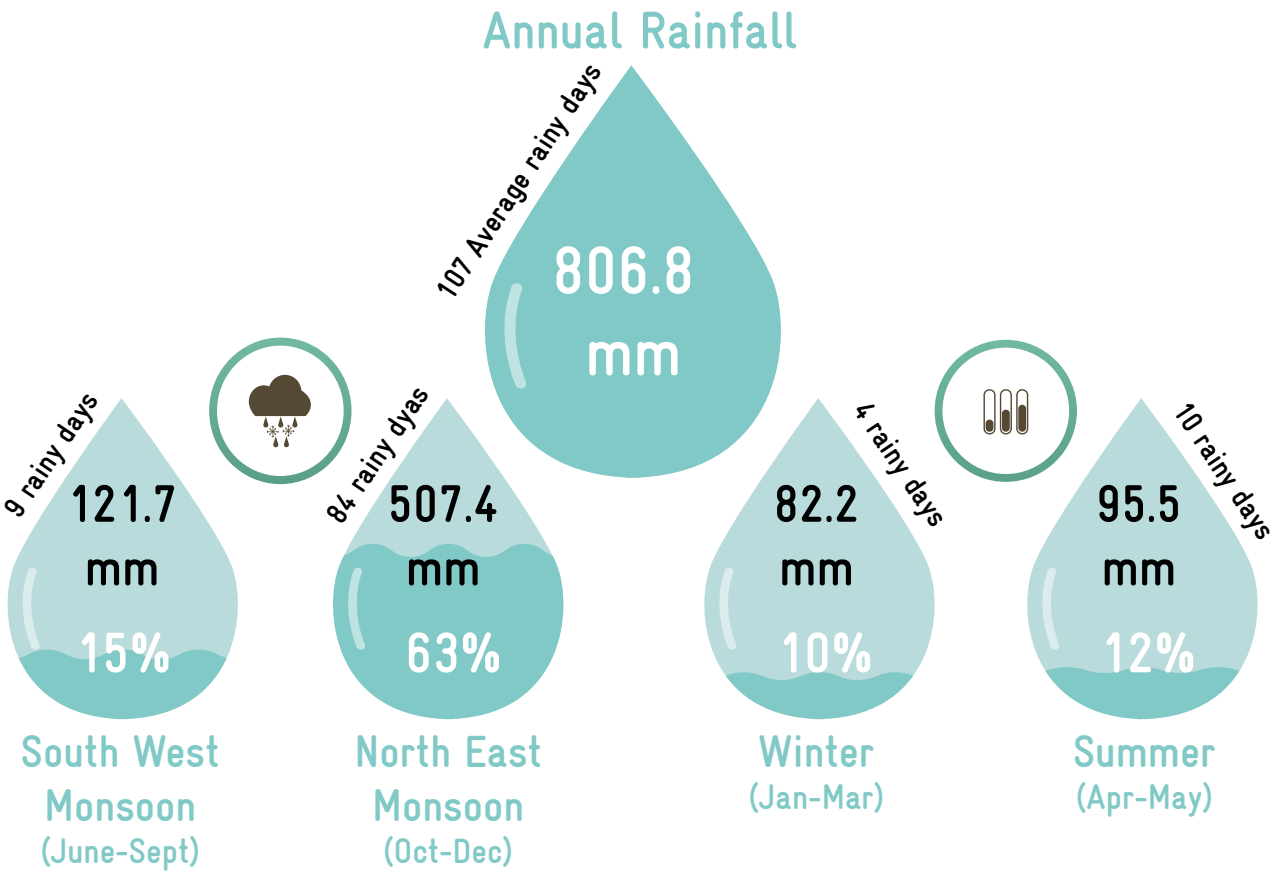


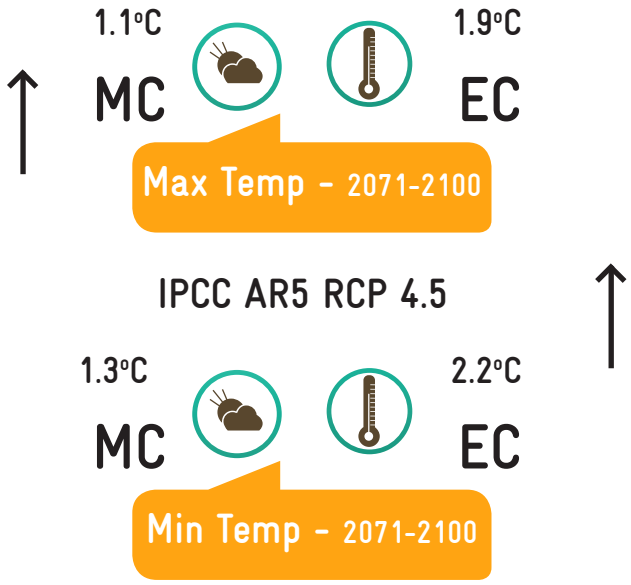
Figure 2.2. Season wise distribution to annual rainfall

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°C and 0.4°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 the rest of the districts of Tamil Nadu. Since this region is heavily dependent on NEM monsoon rains alone, the consecutive deficient rainfall leads to severe drought. As rainfall is the major source for determining water storage, existing water resources, major and minor tanks fail 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. The 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 (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 impacts 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 the recent decades particularly in 2003, 2009, 2016, 2017 and 2019. All parts are affected by drought and its consequences are large areas of crop losses and drinking water scarcity.

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).

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 these 39 locations, 7 locations i.e Chithoor, Sakkarakottai, Karukudi, Karendhal, Thoruvalur, Pullankudi, and R.S. Madai are moderately vulnerable to floods.

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 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 indicate that 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, 7 habitations are in Ramanathapuram 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

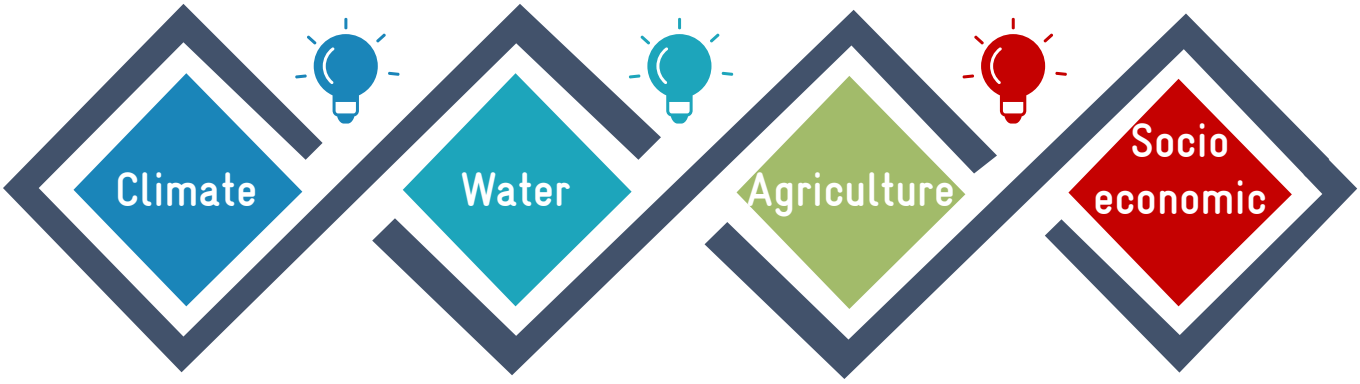
CWRM	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (^{O}C)	C1	Goal 13
	Changes in min temperature (^{O}C)	C2	
	Changes in rainfall (%)	C3	
	Excess rainfall years	C4	
	Deficient rainfall years	C5	
Water	Ground water extraction (%)	W1	Goal 6
	Ground water Recharge (m^3)	W2	
	Surface water availability (mm)	W3	
	Water gap (mcm)	W4	
	% of contamination	W5	
Agriculture	Rainfed area (%)	A1	Goal 15
	Cropping intensity (%)	A2	Goal 2
	Soil moisture (Kg/m^2)	A3	Goal 15
	Evapo-transpiration (Kg/m^2)	A4	
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 COMPREHENSIVE 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, evapo-transpiration 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 the Annual Master Circular issued by MoRD during 2021-22 and the 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 lands 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 in perspective, the macro and micro -watersheds of 500-1000 hectares that often comprise 1-10 Gram Panchayats.

Special focus is given to vulnerable households and communities and are considered while preparing estimates for anticipated demand, list of works on individual lands, 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.

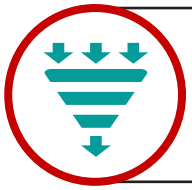
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182 Kinds of works relate to NRM alone

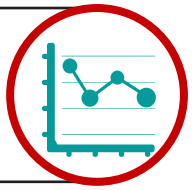
164 Kinds of works related to Agriculture & allied works

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 Geographical Information System (GIS) plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner.

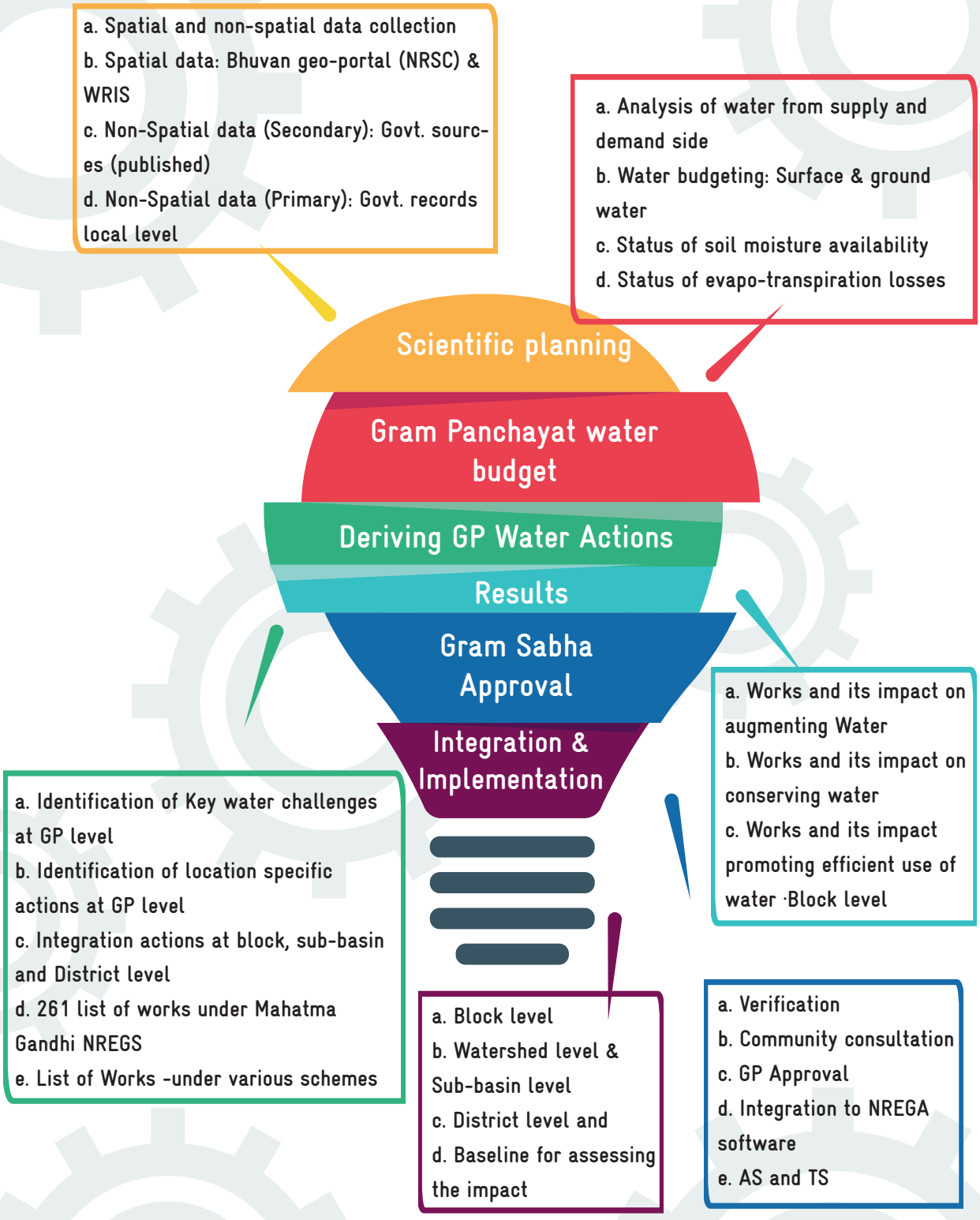


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

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 the 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, evapo-transpira-

tion and soil moisture are used to understand the climate related issues. Lastly, 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 to prepare the water budget for the GP (Box 1).

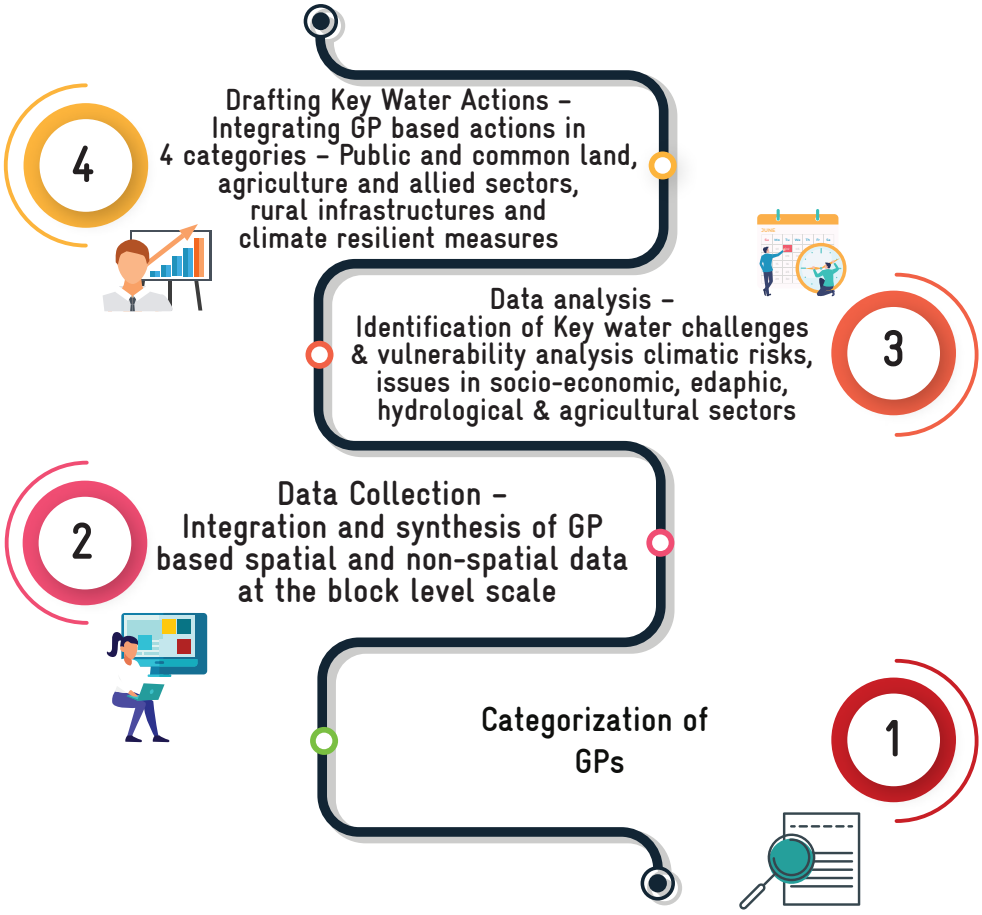
BOX 1. MAJOR COMPONENTS INVOLVE IN CWRM PLANNING WORKOUTS



Such a comprehensive analysis in preparing the water budget integrating ground water, surface water through runoff from rainfall, evapo-transpiration 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 is the key to develop the perspective plan for the water secured GPs and serve as shelf of projects. The 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. STAGES OF CWRM PLANNING PROCESS

PRE-PLANNING STAGE

1. Categorizing GPs for planning as per Mahatma Gandhi NREGS guidelines
2. Human resource and capacity building at administrative levels for planning facilitation
3. Capacity Building of State, District level officers towards implementing the Mahatma Gandhi NREGS
4. Building 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

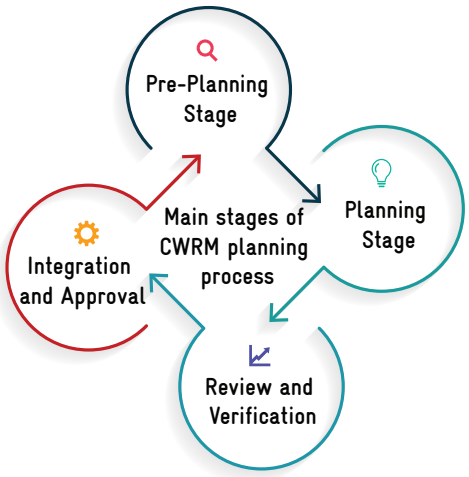
PLANNING STAGE

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 (as per CWRMP guidelines)
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 NRM

4. INTEGRATING GP PLANS TO DEVELOP WASCA DISTRICTS CWRM PLANS

INTEGRATION AND APPROVAL

1. Preparation of Integrated plans (at Block, Watershed levels)
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 NRGES
4. Integrating verified, approved works into NREGA soft (MORD NIC Portal) for mainstreaming WASCA
5. Regular review on progress at each level

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 boundaries for GIS planning, various GP's are categorized based on revenue village boundaries, for collecting and organizing the data-sets. Based on the above factors, five different types of GPs are classified as Type I, II, III, IV and V. The description on categorization of GP's is annexed (Annexure 1). Details of categorization of GPs in Ramanathapuram Block is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF RAMANATHAPURAM BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
12	GP and revenue village data and boundary match (Type-I)	Achchundanvayal, Chitoor, Athyuthu, Chittrakottai, Ilamanoor, Madhavanur, Puthendal, Naranamangalam, Pullangudi, Peruvayal, Thoravallur, Surankottai
9	Having more than one GPs in one Revenue Village (Type-II)	Kavanur, Karukudi, Thiruvolhiyakalugoorani, Madakottan, Paravoor, Kalanikudi, Devipattinam, Sakkarakottai, Therkutharavai
2	One GP is falling under more than Type 1 one Revenue Village (Type III)	Karendal, Rajasuriyamadai
2	GPs having more than one GP, one Revenue Villages data, boundary (Type-IV)	Pandamangalam, Vennathur

3.3 DATA COLLECTION – SPATIAL & NON SPATIAL

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 based analysis is to understand the hydrological and administrative boundaries. This aids in understanding the profile and condition of the watershed at macro or micro level 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 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

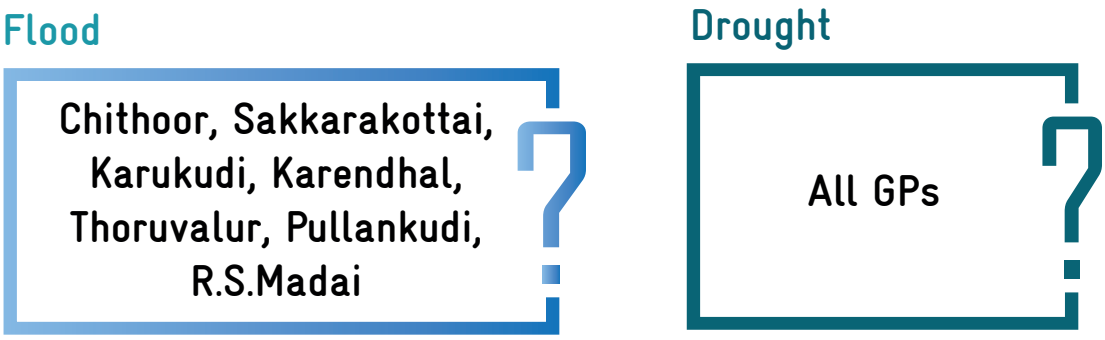
The vulnerability of the groundwater quality, seawater intrusion in the aquifers were assessed and spatially mapped for Ramanathapuram District. The water quality samples were collected from 380 locations throughout the district during pre-monsoon and post-monsoon season. The collected samples were analyzed using standard methodology for calculating Water Quality Index (WQI) and Seawater 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. Water quality Standards and formulas used in this study are given in Annexure 3.6.

3.4 CWRM PLANNING ANALYSIS – CLIMATE

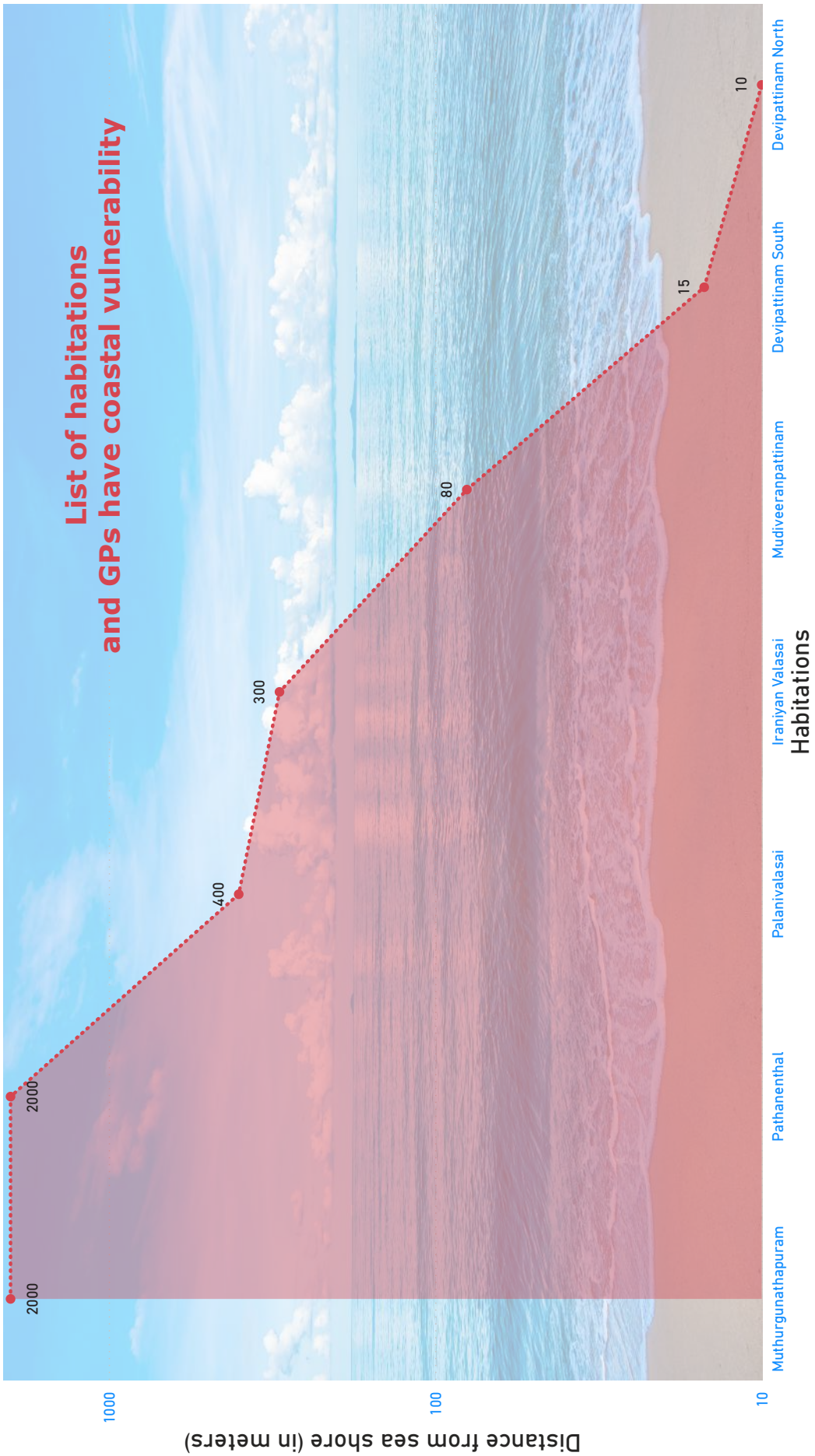
All the CWRM parameters are intended at Block level. On the other hand, all the climate change observations and projections are at the district or regional level. Current data at the Block level is not available at present. Hence, previous hydro-meteorological disasters are considered to denote Block's change in climate (temperature, rainfall) extremities and its risks, which was recorded by State Disaster Management Agency, 2020 (Table 5).

TABLE 5. CLIMATE RISKS AND VULNERABLE GP's



LIST OF HABITATIONS AND GPs HAVE COASTAL VULNERABILITY

GP name	Habitations
Devipattinam	Devipattinam North, Devipattinam South
Chitharkottai	Mudiveeranpattinam, Palanivalasai
Athiyuthu	Iraniyan Valasai
Vennathoor	Pathanenthal
Regunathapuram	Muthurgunathapuram


List of habitations
and GPs have coastal vulnerability
Distance from sea shore (in meters)
1000
100
10
2000
2000
400
300
80
15
10
Muthurgunathapuram
Pathanenthal
Palanivalasai
Iraniyan Valasai
Mudiveeranpattinam
Devipattinam South
Devipattinam North
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 the 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, 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. Ramanathapuram Block is engrossed with costal origin landform units (Figure 3.1). 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 activities under CWRM plan preparation.

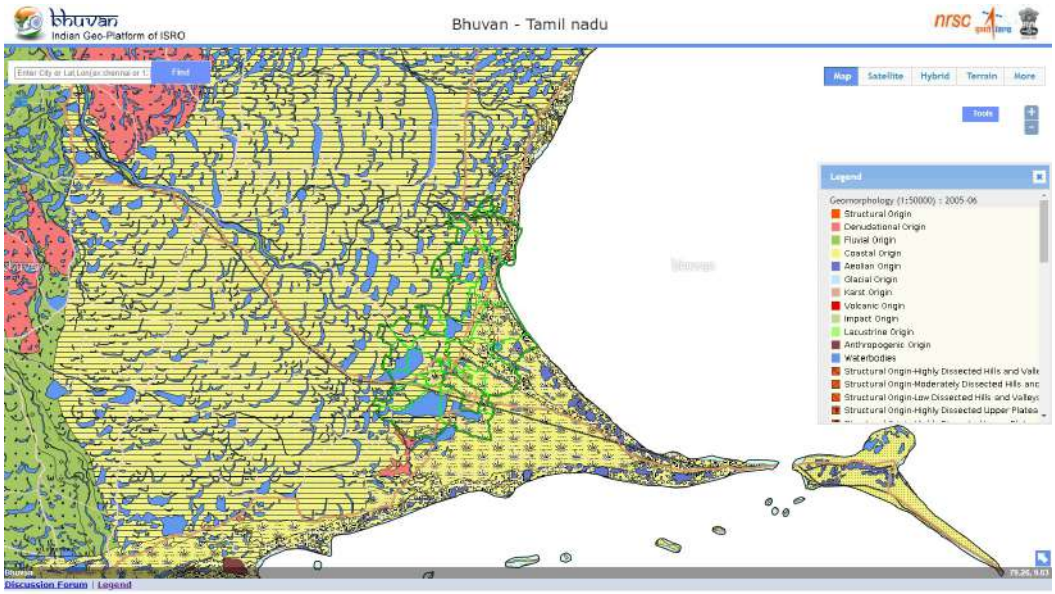


Figure 3.1. Geomorphology map

Origin	Area coverage in %	Gram Panchayat
Coastal Origin - Older Deltaic Plain		
	84%	Kalanikudi, Karendal, Karugudi, Kavanur, Mathavanoor, Naranamangalam, Pandamangalam, Peruvayal, Toruvalur - 100%, Puthenthal - 90%, Achchundanvayal, Chithoor, Vennathur - 80%, Surankottai - 75%, Pullangudi - 60%, Rajasuriamadai - 50%, Therku Tharavai - 20%
Coastal Origin - Older Coastal Plain		
	66%	Madakkotan, Peravoor, Sakkarakottai - 100%, Athyuthu - 90%, Chittrakkottai, Devipattinam - 85%, Therku Tharavai - 80%, Kalugoorani - 50%, Ilamanoor - 20%, Surankottai - 10%, Pullangudi - 5%
Coastal Origin - Younger coastal Plain		
	11%	Kalugoorani - 20%, Vennathur - 15%, Athyuthu, Chittrakkottai - 10%, Devipattinam, Ilamanoor - 5%

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.

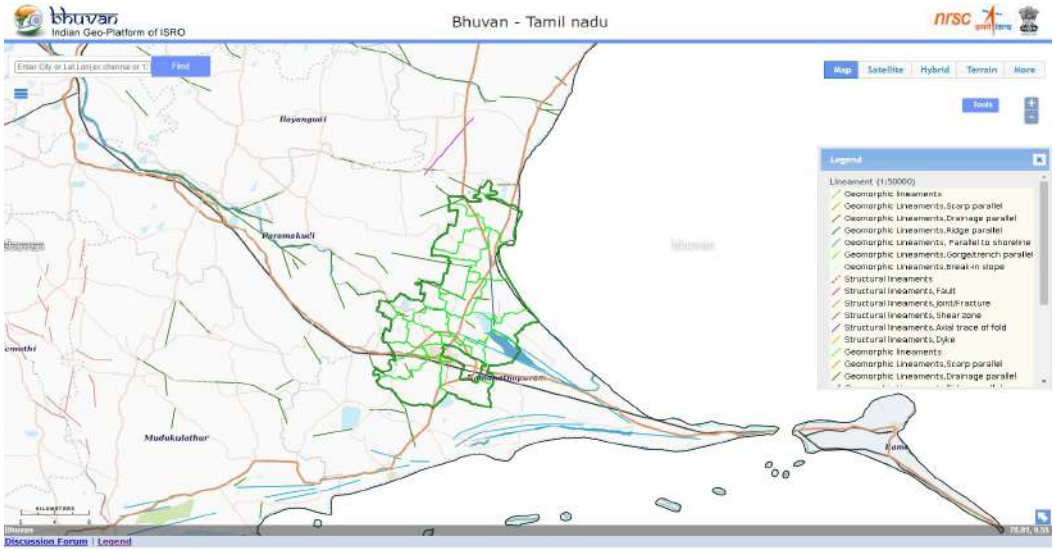


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Geomorphic lineaments, Drainage parallel	Chithoor, Chittrakkottai, Ilamanoor, Karendal, Karugudi, Kavanur, Naranamangalam, Peruvayal, Pullangudi, Toruvalur, Vennathur, Puthenthal
Geomorphic lineaments, Ridge parallel	Chittrakkottai, Devipattinam, Athyuthu
Geomorphic lineaments, parallel to shoreline	Kalugoorani

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.

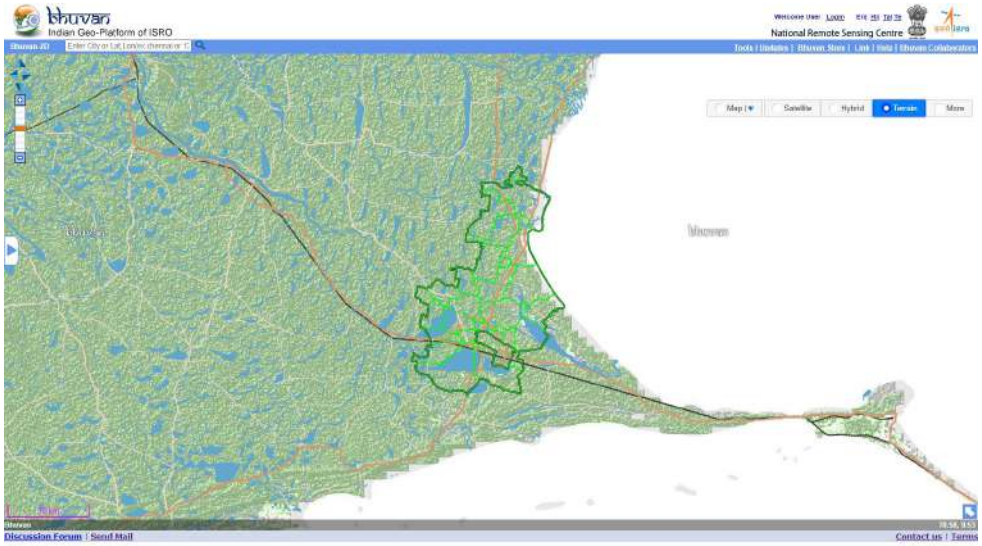


Figure 3.3. Terrain map

3.5.1.4 DEM: 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., Ramanathapuram Block DEM is shown in Figure 3.4.

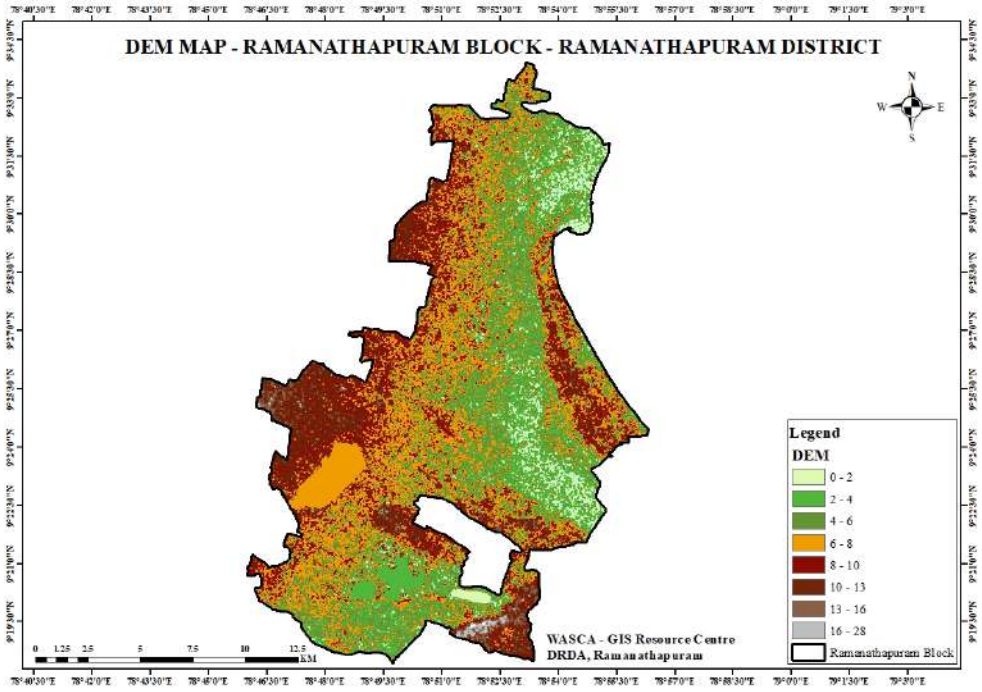


Figure 3.4. DEM map

3.5.1.5 Slope: The 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. Very flat slope ranges from 0 to 1 % is noticed in the Block (Figure 3.5). 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.

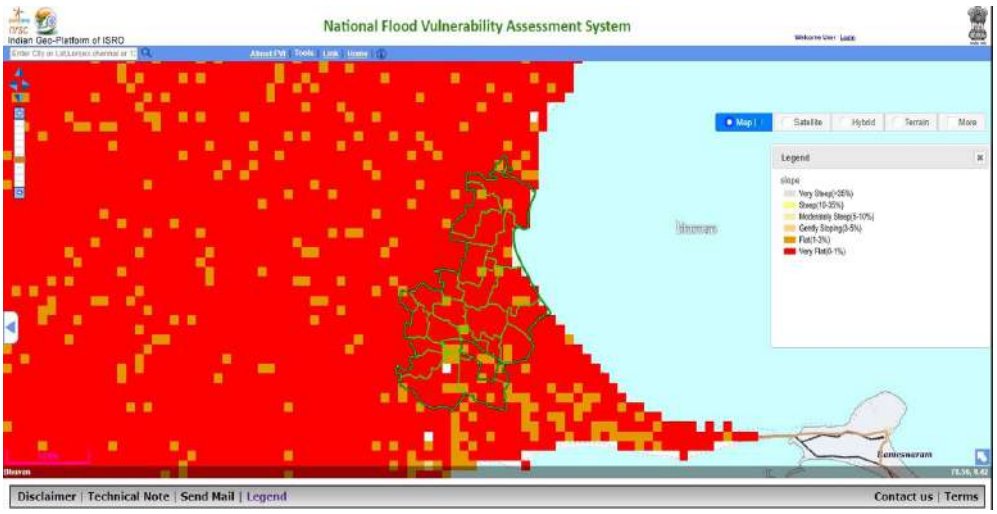


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Very Flat (0-1%)	94%	Athyuthu, Chithoor, Ilamanoor, Kalanikudi, Karendal, Mathavanoor, Surankottai - 100%, Karugudi, Madakkotan, Naranamangalam, Peravoor, Peruvayal, Puthenthal, Vennathur - 95%, Chittrakkottai, Devipattinam, Kalugoorani, Pullangudi, Rajasuriamadai, Toruvalur - 90%, Therku Tharavai - 85%, Sakkarakottai - 80%
Flat (1-3%)	9%	Sakkarakottai - 20%, Therku Tharavai - 15%, Chittrakkottai, Devipattinam, Kalugoorani, Pullangudi, Rajasuriamadai, Toruvalur - 10%, Karugudi, Madakkotan, Naranamangalam, Peravoor, Peruvayal, Puthenthal, Vennathur - 5%

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-West from East in 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.

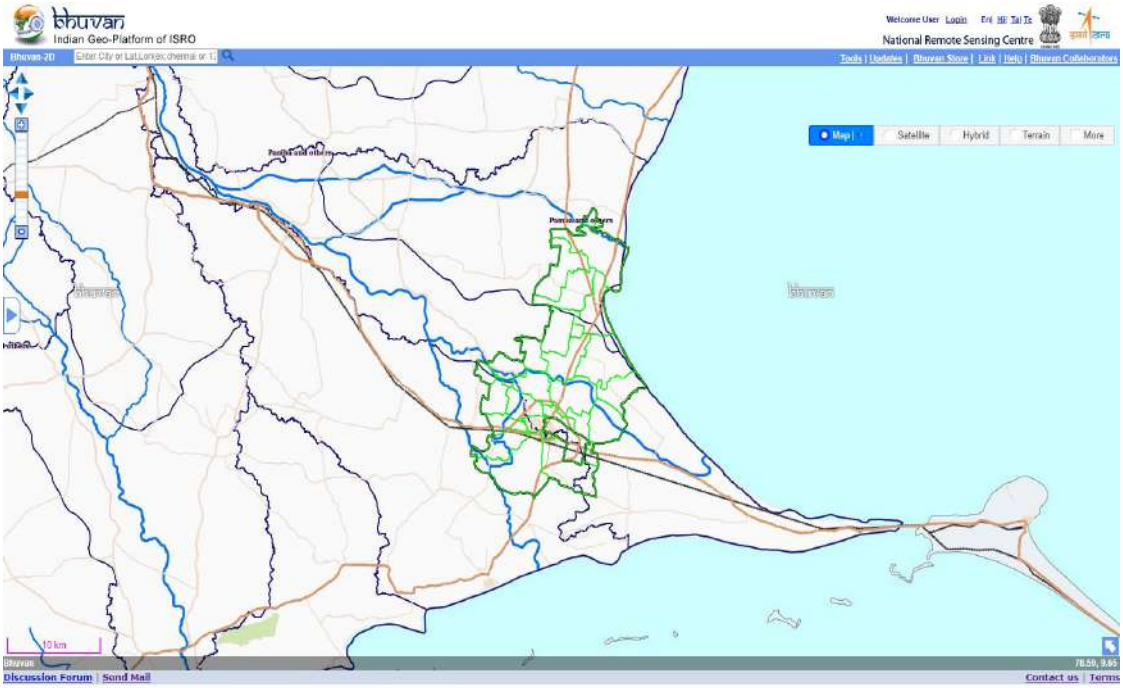


Figure 3.6. Drainage network

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. Ramanathapuram 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 and also aids in strengthening the durability of land, soil and water conservation structures in downstream.

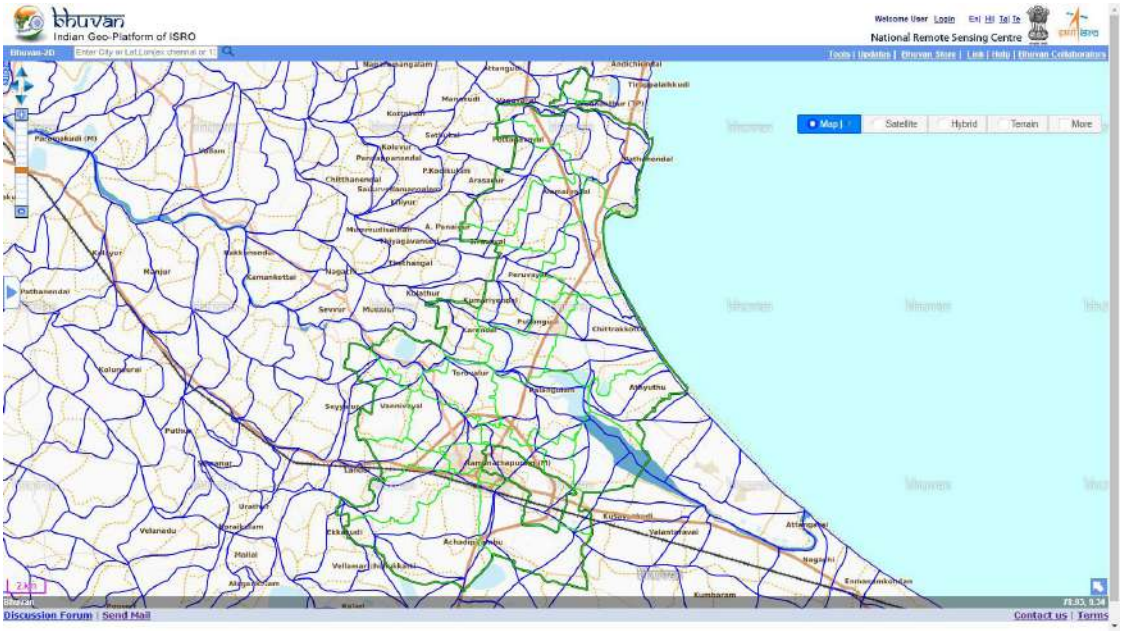


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water is one of the important natural resources in a semi-arid region like Ramanathapuram Block. The ground water perspectives map is the integration of lithology, geo-morphology, 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. GPs which are situated in the Eastern side and along the coast shore witness the GW in less than 30 m with yield of 50 to 100 LPM (Figure 3.8). The GPs wise details of GW prosperity is shown in the illustration below. This specific information will play a crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

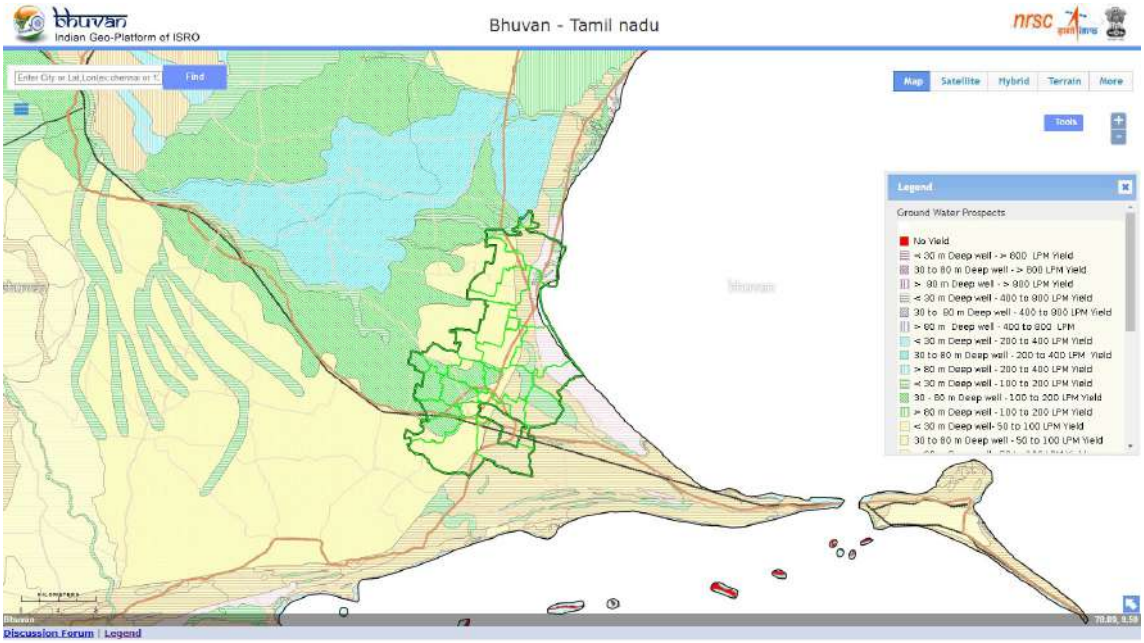


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat

<30m Deepwell - 100 to 200 LPM Yield

29%

Kalugoorani - 60%, Ilamanoor - 25%, Chittrakkottai - 20%, Vennathur - 10%

30-80m Deep Well-100 to 200 LPM Yield

74%

Achchundanvayal, Chithoor, Karugudi - 100%, Surankottai - 95%, Toruvalur - 85%, Puthenthal - 60%, Kavanur - 45%, Ilamanoor - 10%

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

58%

Kalanikudi, Karendal, Peruvayal - 100%, Naranamangalam, Pullangudi - 95%, Rajasuriamadai - 90%, Kavanur, Mathavanoor - 65%, Peravoor, Puthenthal - 45%, Ilamanoor - 40%, Vennathur - 15%, Chittrakkottai - 10%, Therku Tharavai, Toruvalur - 5%

<30 m Deep well -30 to 50 LPM Yield

58%

Madakkotan, Sakkarakottai - 100%, Therku Tharavai - 95%, Devipattinam - 55%, Kalugoorani, Vennathur - 50%, Athyuthu - 45%, Chittrakkottai, Mathavanoor - 40%, Naranamangalam - 5%

<30 m Deep well -10 to 20 LPM Yield

46%

Athyuthu - 55%, Chittrakkottai - 50%, Vennathur - 45%, Devipattinam - 35%

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

Canal Network	Extent
Canal Network (m)	
Length of Main Canal (m)	51,564
Length of Minor Canal (m)	1,33,100
Length of Distributaries (m)	1,38,600
Water Courses (Field Channels) (m)	1,52,741
Traditional Water bodies (No.)	
Number of Tanks (PWD & Union	53
Number of Ooranis	232
Irrigation Facilities (ha)	
Tank Irrigation	4,514.72
Canal Irrigation	225.09
Open & Tube Well Irrigation	1,461.25
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	1,469.10
Average Catchment Area	1,506.30
Bad Catchment Area	1,428.20
Watershed and Drainage Networks	
Length of Natural Drainage Lines (m)	94,745.68
Number of Natural Drainage Lines (No.)	95.00
Number of Micro-Watersheds (No.)	172.00
Water Demand	
For Humans (ha.m)	233.51
For Livestock (ha.m)	38.05
For Agriculture (ha.m)	10,462.33
GW Utilization for Drinking (%)	80.72
GW Utilization for Livestock (%)	74.52
GW Utilization for Agriculture. (%)	20.67
SW Utilization for Drinking (%)	19.28
SW Utilization for Livestock (%)	25.48
SW Utilization for Agriculture (%)	79.33

3.5.2.1 Existing Water Structures

Waterbodies are the life line of local communities for their lives and livelihoods. The Block has structured traditional water storage units such as tanks and Ooranis. It is noticed that the Ooranis are more (232) than tanks (53) (Figure 3.9).

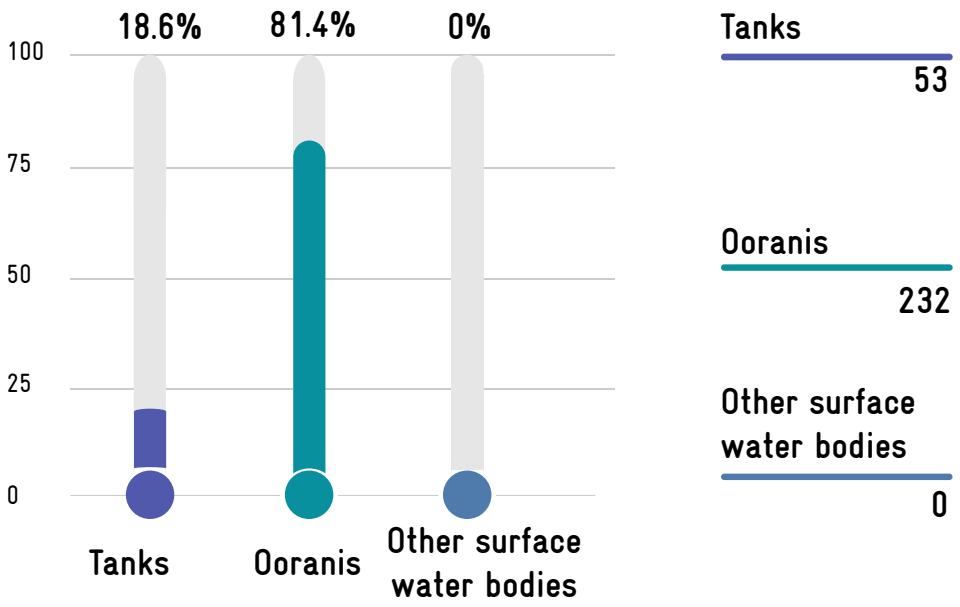


Figure 3.9. Traditional Waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 6,201 ha, of which 72.8 % (4,514.72 ha) is irrigated through tanks, followed by 23.56 % (1,461.25 ha) through open/tube well and the remaining 3.64 % (225.09 ha) area is through canals-based irrigation (Figure 3.10).

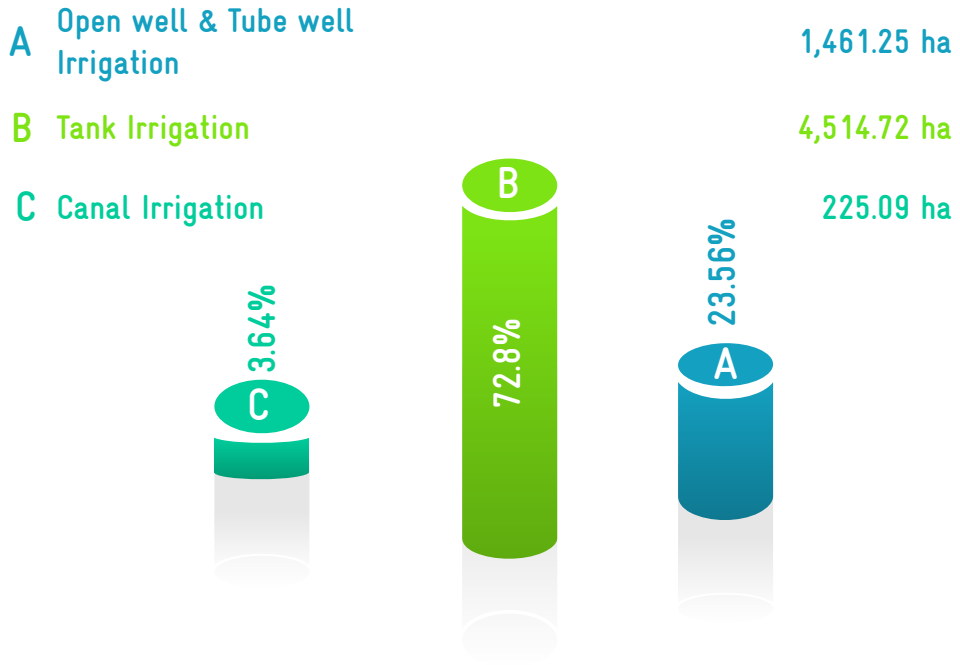


Figure 3.10. Irrigation sources

3.5.2.3 Available Run off

The total available runoff in the catchment area is 4,403 ha.m out of which 33.36 % is from good catchment area followed by 32.43 % is from bad catchment area and the remaining 34.21 % is from average catchment area. As the area has worse catchment area, the runoff generated is more (Figure 3.11).

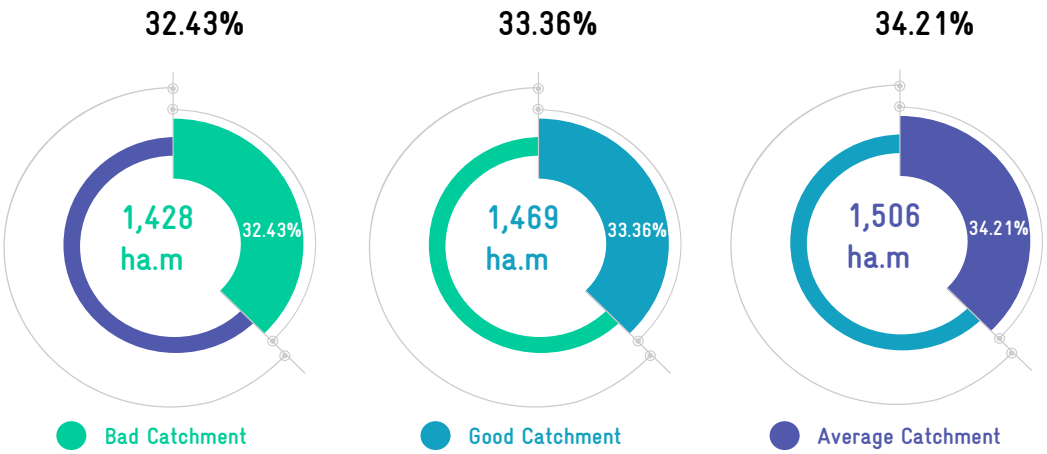
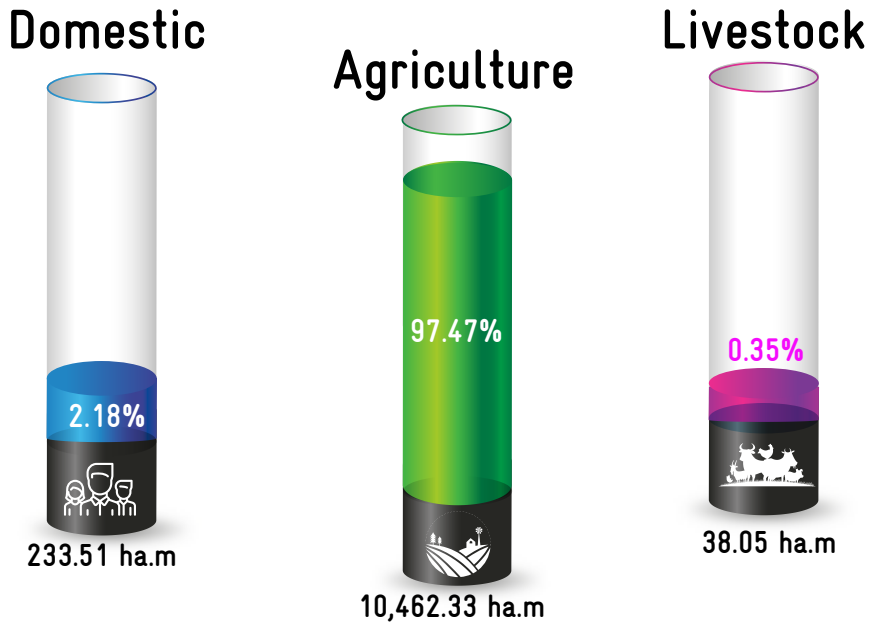


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 10,733 ha.m. The highest demand is from the agriculture sector of 10,462.33 ha.m (97.47 %) followed by domestic use demand of 233.51 ha.m (2.18 %) and rest is from livestock.



Out of the total water demand, 80.72 and 74.52 % usage of water for domestic and livestock purpose is met through ground water while 79.33 % usage of water for Agriculture is met through surface water sources (Figure 3.12).

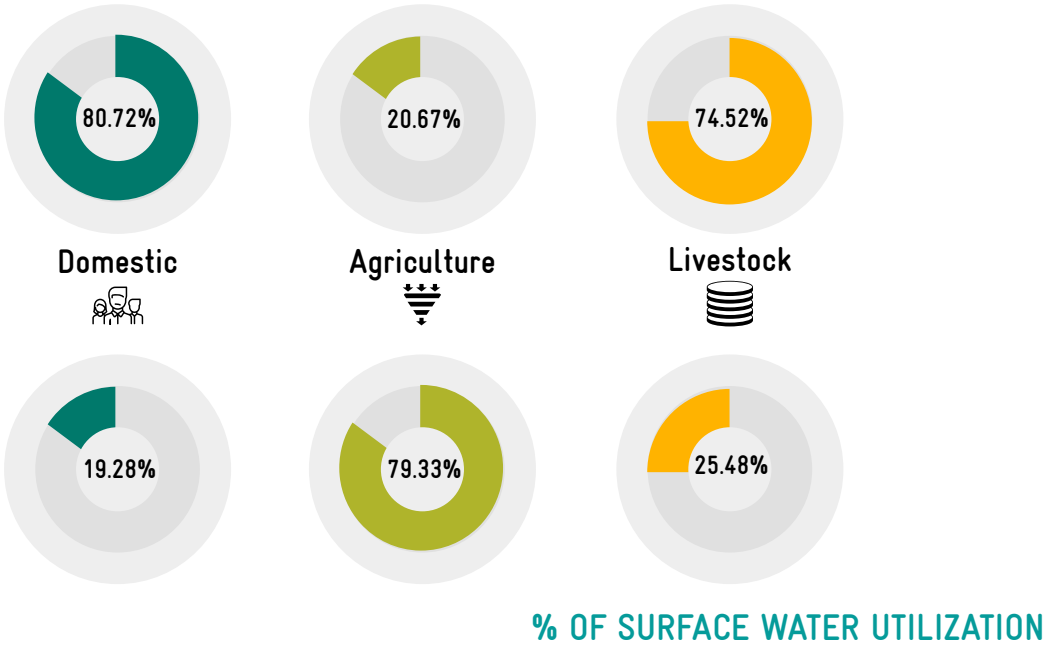


Figure 3.12. Sector-wise water utilization

3.5.3 ANALYSIS OF PHYSICOCHEMICAL PARAMETERS

Physicochemical parameters were assessed to understand their influences on the 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 the Block area, out of which 18 samples were of open well water and remaining were from ground water (Figure 3.13).

Figure 3.13. Location of water samples

3.5.3.1 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, HCO3, Cl, SO4, NO3, Ca, Mg, Na and K to determine the water quality. The results showed that the average content of ions was as follows: Cl > TA > TH > HCO3 > Na > Ca > Mg > CO3 > S04 > K > NO3. The predominant hydro-chemical parameters 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 spots (blue colour in Figure 3.10) over the Block area while very poor-quality water/ unsuitable water for domestic purpose with index value >300 is found in two spots. Buffer area of very poor sites falls under poor quality water of index zone ranging from 200 to 300. However most of the area falls under good water quality zone of index value range good to medium (50-100) (Figure 3.14). These zones act as inputs in identifying suitable sites to propose appropriate treatment measures. Location wise water quality during pre and post monsoons are attached in Annexure 3.8 and 3.9.

Physicochemical parameters	Cl	TH	Na	TA	HCO_3	Ca	Mg	CO_3	$S0_4$	K	NO_3
Average in mg/l	799.83	429.17	341.42	331.00	231.52	199.05	135.76	69.98	61.30	18.84	17.16

(TH = Total hardness, TA = Titratable acidity, Ca =calcium, Na= Sodium, Cl= Chloride, HCO3=Bicarbonate, Mg= Magnesium, SO4= Sulphate, NO3= Nitrate, K= Potassium, CO4= Carbonate)

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

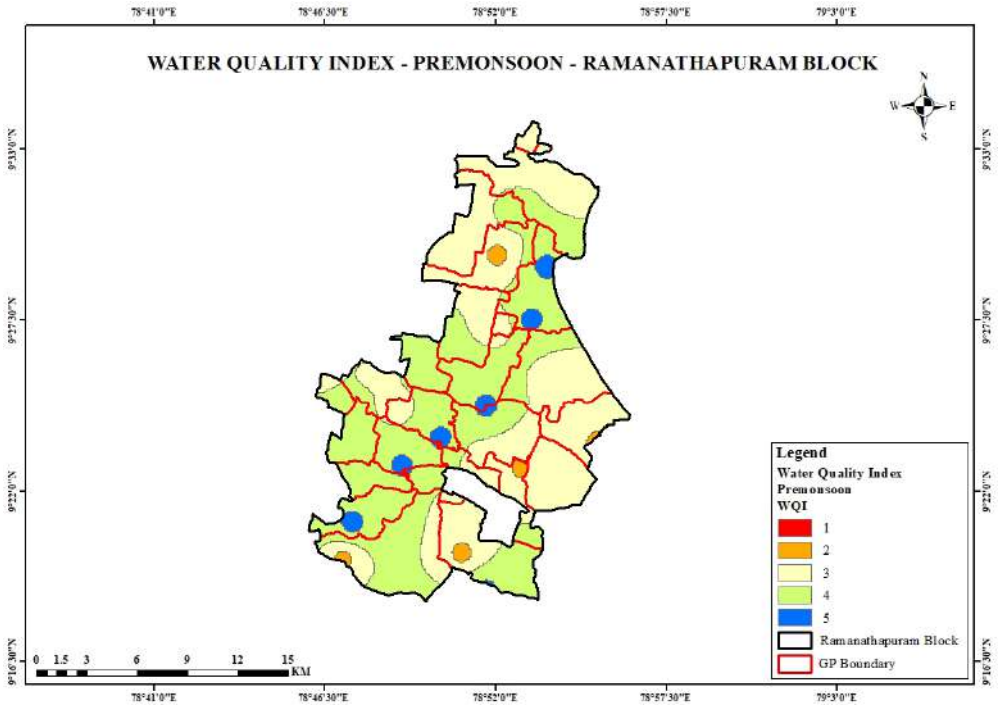


Figure 3.14. Water Quality Index

3.5.3.2 Seawater Mixing Index

SMI 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, one spot was found with high SMI while there were nine zones with less sea water mixed. However, most of the Block area falls under the index value range 2- 3 which is moderate (Figure 3.15).

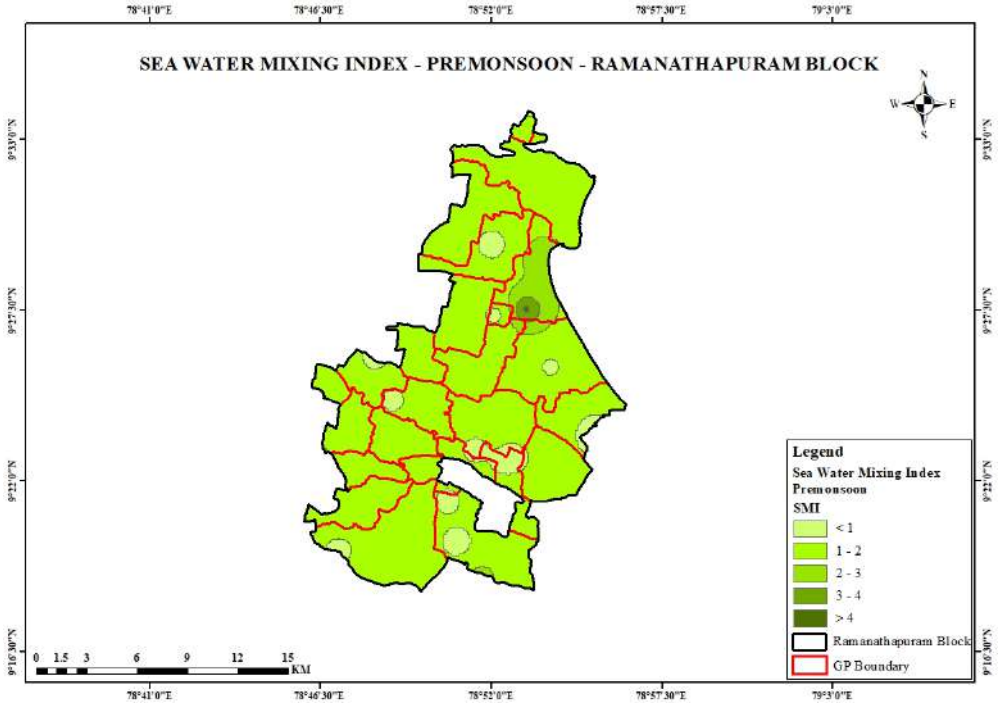


Figure 3.15. Seawater Mixing Index

3.5.3.3 Salinity

Seawater mix and salinity in the water are directly proportional, higher the sea water mix higher the salinity in the water (Figure 3.16).

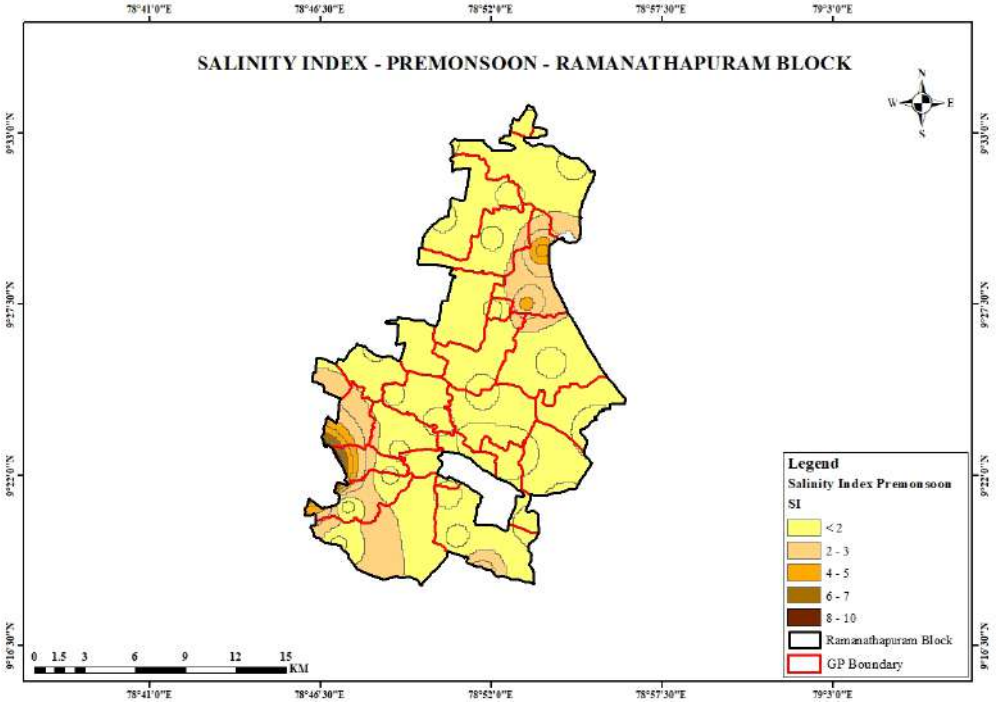


Figure 3.16. Salinity Index

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

Agriculture is the primary livelihood of the households in Ramanathapuram 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 are taken into consideration to understand Ramanathapuram Block's problems in order to draft scientific key water actions.

3.6.1.1 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.

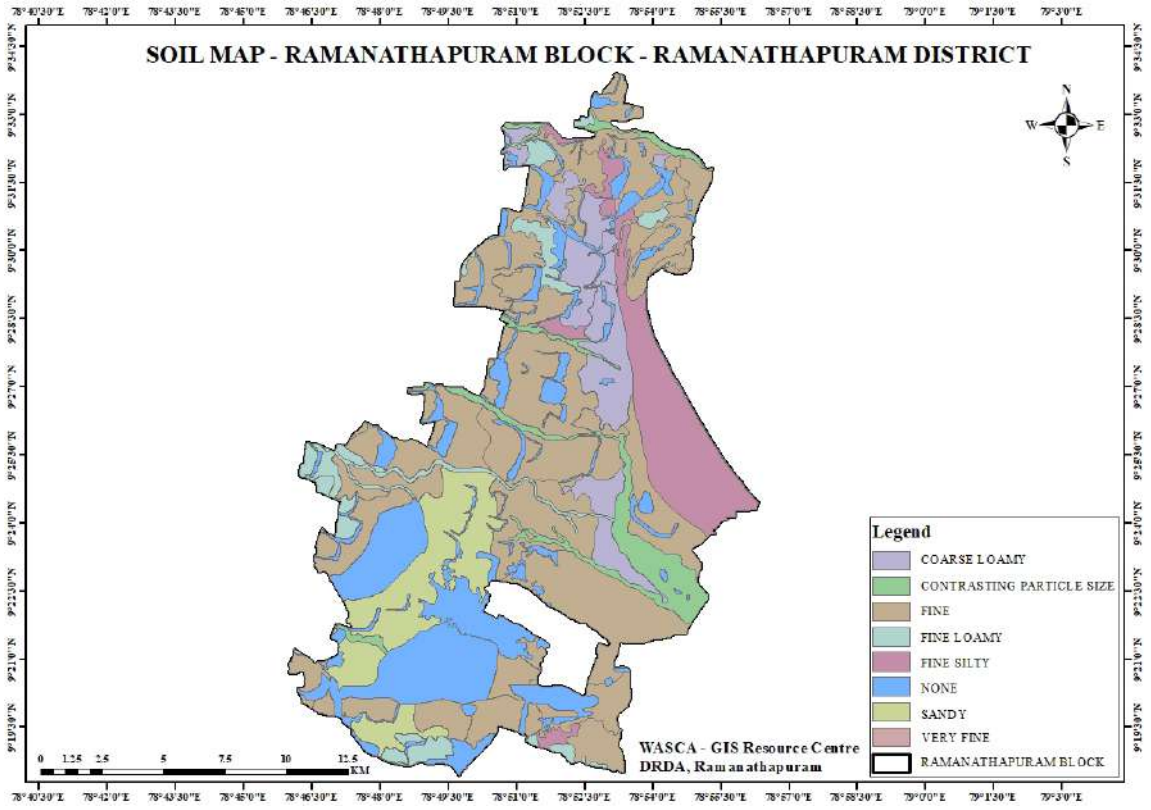


Figure 3.17. Soil texture

3.6.1.2 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 of 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.

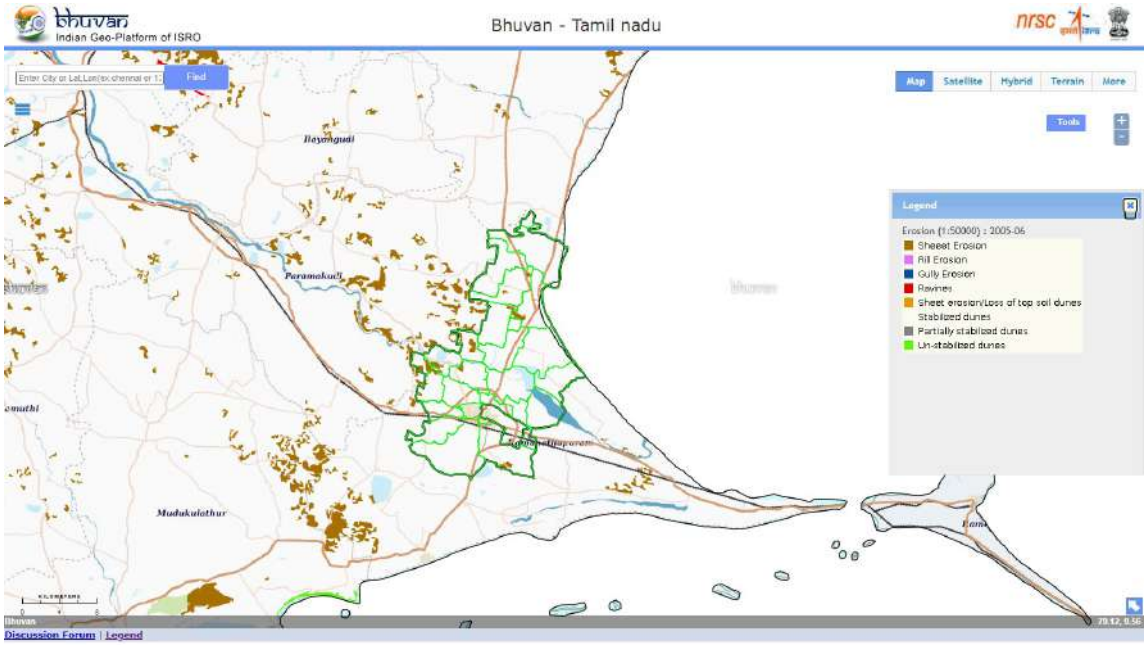


Figure 3.18. Soil erosion map

Erosion type	Area in %	Gram Panchayat
Sheet Erosion		
	13%	Karugudi - 45%, Karendal - 25%, Kavanur - 20%, Chithoor, Devipattinam, Mathavanoor, Peruvayal, Therku Tharavai, Toruvalur - 5%

3.6.1.3 Land Use & Land Cover (LULC): 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. Ramanathapuram Block is majorly covered by agricultural crop, followed by forest/mangrove swamp area (Figure 3.19). The GP wise LULC is tabulated in the table below. LULC map helps the decision makers and planners to focus on the fallow land development activities.

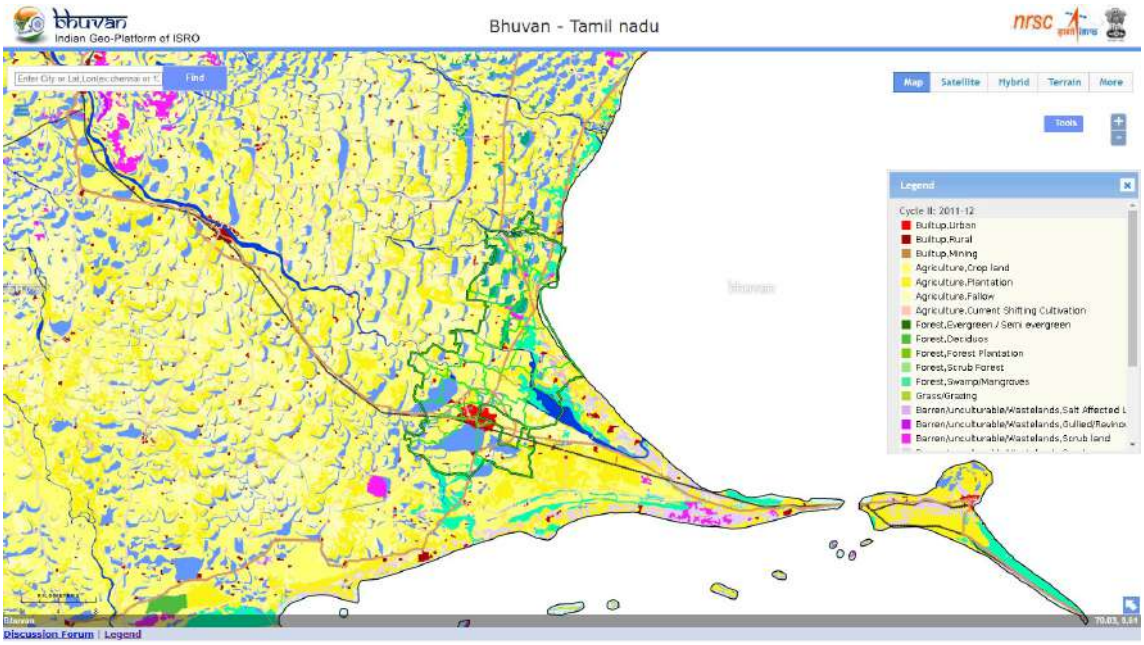


Figure 3.19. Land Use Land Cover map

Land Use	Area coverage in %	Gram Panchayat
Barren Lands/Scrub Lands	6%	Devipattinam - 10%, Peruvayal, Mathavanoor, Vennathur - 5%
Forest, Deciduous	20%	Mathavanoor - 40%, Naranamangalam - 30%, Vennathur - 20%, Devipattinam - 15%, Peruvayal - 10%, Pullangudi - 5%
Forest, Swamp/Mangroves	20%	Chittrakkottai, Ilamanoor - 30%, Vennathur - 25%, Athyuthu, Kalugoorani - 20%, Pullangudi - 15%, Devipattinam, Rajasuriamadai - 10%
Barren/Un-cultivable/wastelands, salt affected land	25%	Chittrakkottai - 30%, Athyuthu - 20%
Agriculture, Fallow lands	41%	Madakkotan - 95%, Peravoor - 80%, Kalugoorani - 35%, Peruvayal - 15%, Karendal, Therku Tharavai - 10%
Agriculture, Crop lands	45%	Karugudi - 80%, Karendal, Toruvalur - 70%, Ilamanoor - 60%, Rajasuriamadai - 50%, Pullangudi, Puthenthal - 45%, Kavanur - 35%, Chittrakkottai - 30%, Mathavanoor - 25%, Naranamangalam - 15%, Achchundanvayal - 10%
Agriculture, Plantation	35%	Kavanur - 65%, Therku Tharavai - 50%, Devipattinam - 45%, Surankottai - 40%, Peruvayal - 20%, Puthenthal - 15%, Kalugoorani - 10%
Builtup, Rural	5%	Athyuthu, Chittrakkottai, Kavanur, Peruvayal, Pullangudi, Rajasuriamadai, Sakkarakottai, Surankottai, Therku Tharavai, Toruvalur

3.6.1.4 Waste land: A Parcel of land that is not suitable for any agricultural 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 type wasteland is noticed in Ramanathapuram 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.

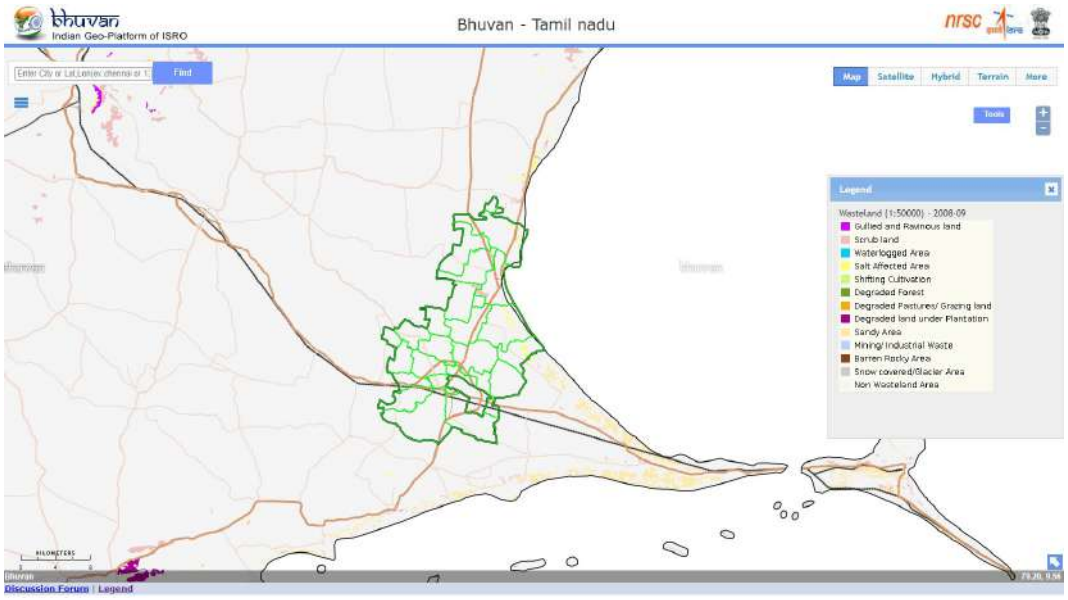
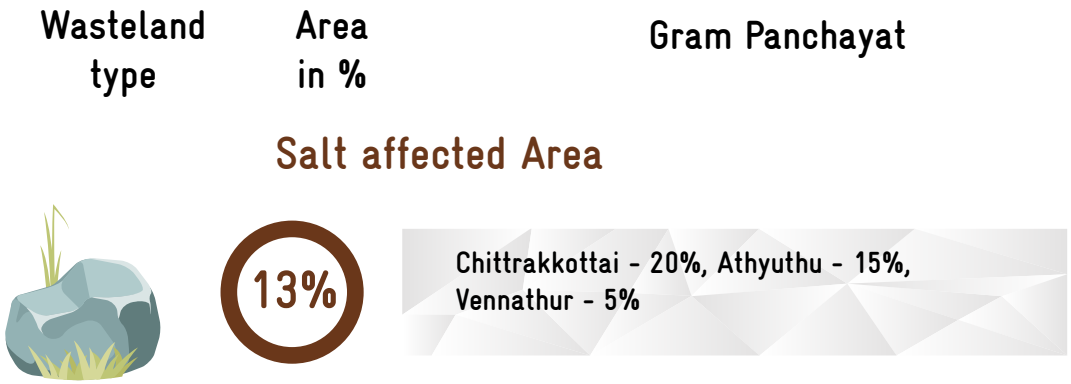


Figure 3.20. Wasteland map



3.6.1.5 Salt affected area: Due to the Block's proximity to coastal region, one fourth of the Block area is sodic and same was also found in the results of salinity analysis of water samples (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.

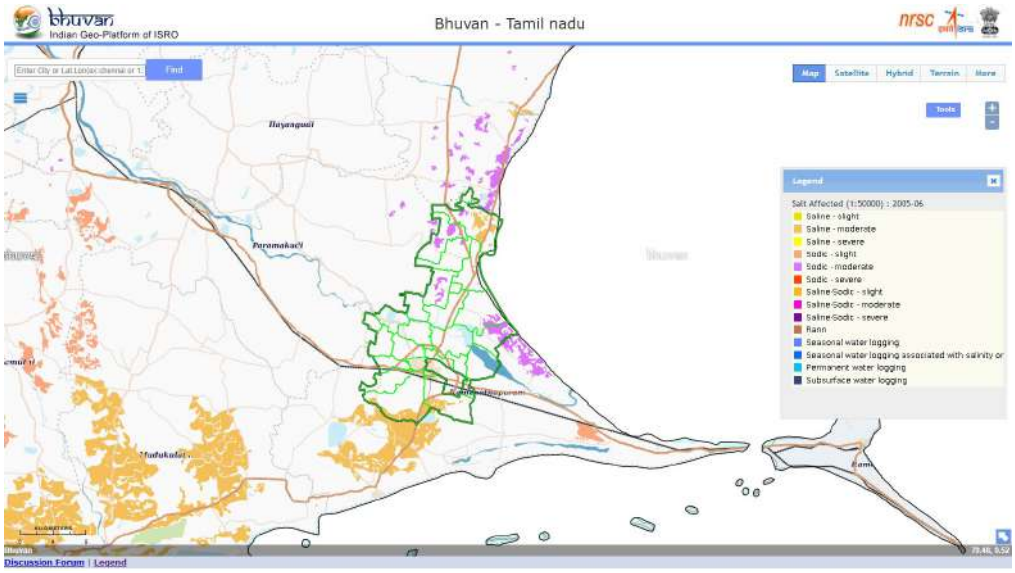


Figure 3.21. Salt affected area

Thematic unit	Area in %	Gram Panchayat
Sodic – Moderate		
	26%	Athyuthu - 50%, Peruvayal - 30%, Naranamangalam - 25%, Chittrakkottai - 20%, Vennathur - 5%
Sodic-Slight		
	47%	Vennathur - 55%, Therku Tharavai - 45%, Rajasuriamadai - 40%

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 7). The key CWRM parameters of agriculture area for all GPs are tabulated in Annexure 3.10.

TABLE 7. CWRM PARAMETER BASED AGRICULTURE RESOURCES STATUS IN THE BLOCK

Key parameter	Extent
Area under Land Resources (ha.)	
Non-Agricultural Uses	4,842.41
Area under Barren & Un-cultivable Land	1,779.80
Area under Permanent Pastures and other Grazing Land	-
Land Under Miscellaneous Tree Crops etc.	8,131.59
Cultivable Waste Land	707.62
Fallows Land other than Current Fallows	436.59
Current Fallow land	2,133.33
Unirrigated Land	5,068.83
Area Irrigated by Source	4,935.25
Land under Catchment Area (ha)	
Good Catchment	6,622.21
Average Catchment	8,839.21
Bad Catchment	12,574.00
Crop Details	
Irrigated Area (ha)	5,937.37
Rainfed area (ha)	3,391.33
Paddy Cultivation (ha)	7,168.60
Crop Water Requirement - Irrigated condition (ha.m)	7,352.24
Crop Water Requirement - Rainfed condition (ha.m)	3,110.07
Soil Resources: Status of Available Nitrogen (%)	
Very Low	46.95
Low	50.03
Medium	2.35
High	0.45
Very High	0.22
Status of Organic Carbon (%)	
Very Low	14.85
Low	30.86
Medium	11.36
High	13.03
Very High	29.90
Status of Soil Micro Nutrients (%)	
Sufficient	68.24
Deficient	31.76
Status of Physical condition of the soil (%)	
Moderately Acidic	14.95
Slightly Acidic	8.99
Neutral	0.52
Moderately Alkaline	75.24
Soil Texture (%)	
Fine Soil	62.08
Coarse loamy	7.36

Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	17.00
Estimated Soil Moisture (ha.m)	3,942.81
ET Losses (ha.m)	9,466.82
Means of Water Extraction (%)	
Gravity	49.81
Lifting	50.20
Irrigation Methods (%)	
Wild Flooding	79.12
Control Flooding	20.88
Livestock (No.)	
Cattle Population	7,593
Sheep Population	7,592
Goat Population	17,476
Poultry	19,063

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 29 % land is under miscellaneous tree crops, followed by 18.08 % unirrigated land, while less than six percent of land is cultivable wasteland, current fallow and fallow land other than current fallows (Figure 3.22).

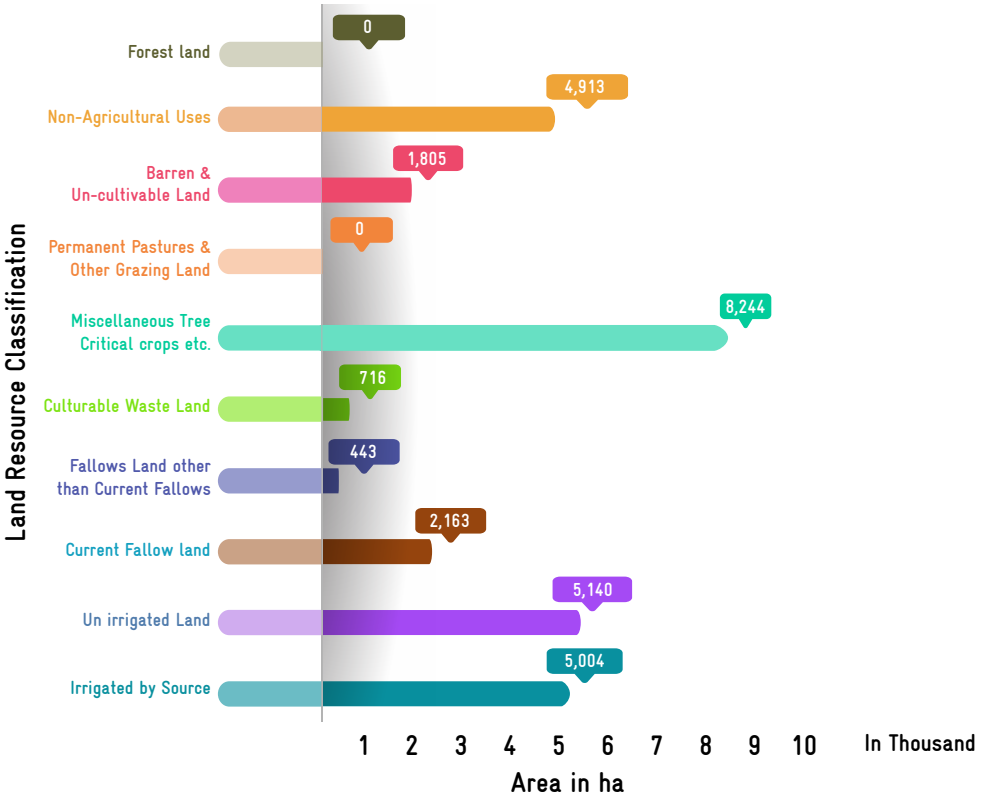


Figure 3.22. Land utilization

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 28,035.42 ha, of the Block, the highest of about 44.85 % from bad catchment area followed by 31.53 % from average catchment area and remaining is from good 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).

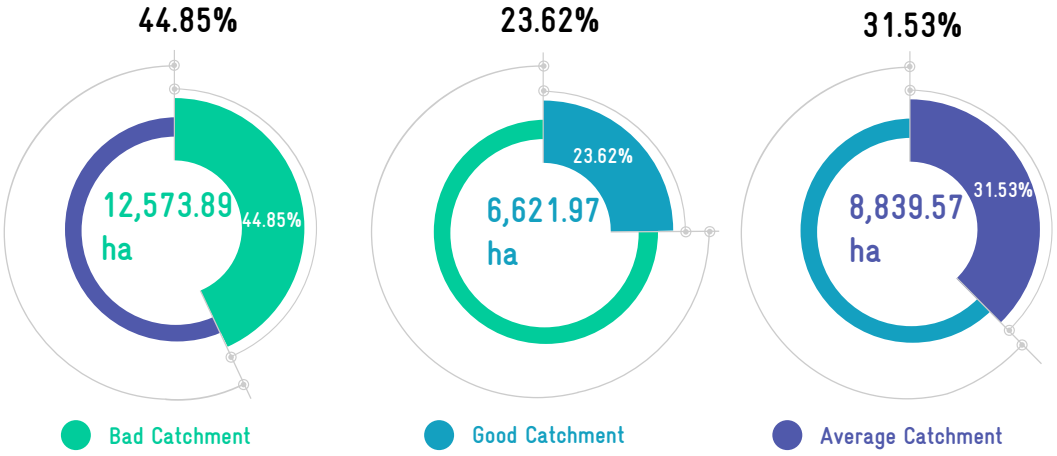


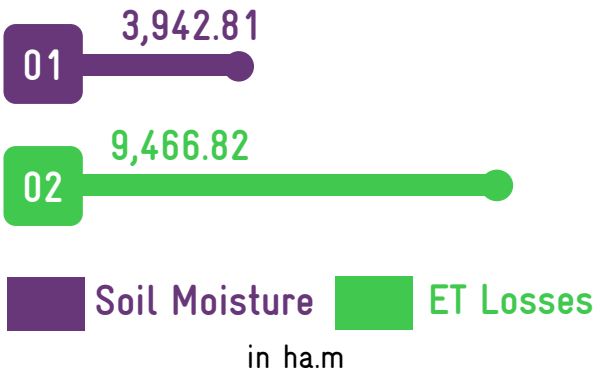
Figure 3.23. Catchment area

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 the 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 (17%), is taken for estimating the amount of water stored as soil moisture which accounts to 3,942.81 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 9,466.82 ha.m during 2018-19, with a monthly average of 799 ha.m.



3.6.2.5 Macro-nutrients
Nitrogen

The available nitrogen is very low in 46.95 % of the samples tested while it was 50.03 % under low category and least of 0.22 % area with very high Nitrogen (Figure 3.24). According to soil resource map, this Block is identified as one of the nitrogen deficient Blocks (Ramanathapuram District profile 2020).

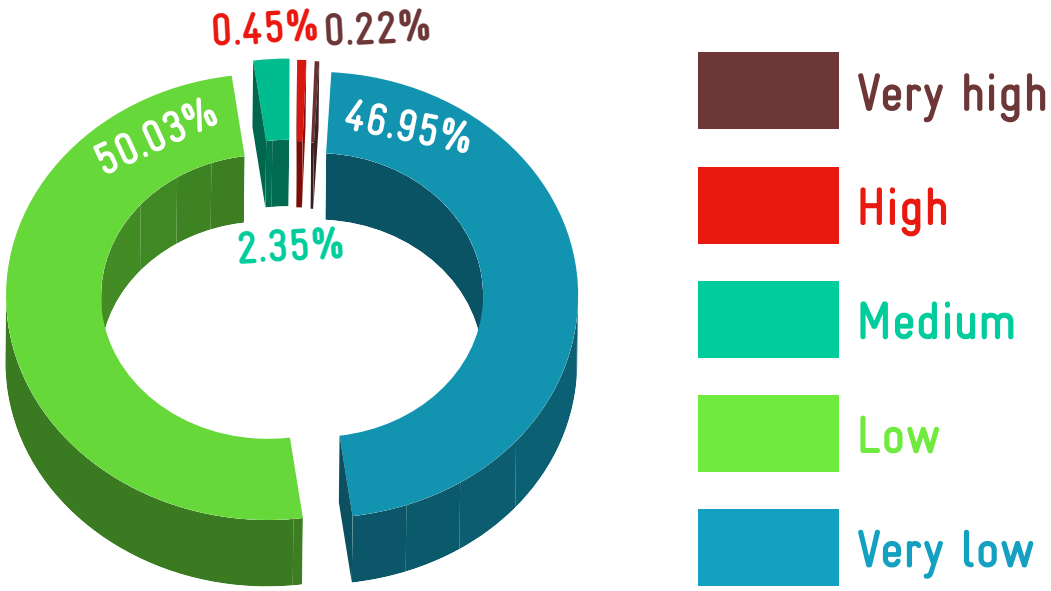


Figure 3.24. Status of available Nitrogen

Organic Carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. 30.86 % of the soil samples tested fall under low category followed by 29.90 % which falls under very high category while less of 11.36 % samples are witnessed with medium high organic carbon (Figure 3.25). This indicates that the soil fertility is moderately poor.

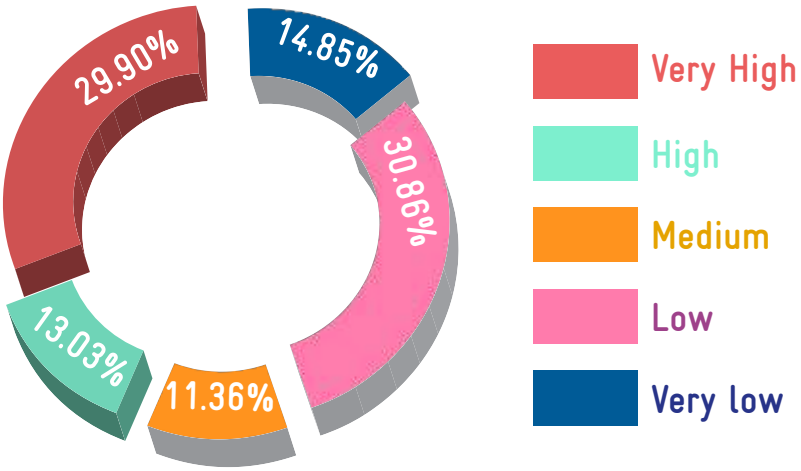


Figure 3.25. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro-nutrients

This Block is one of the Nitrogen, zinc and ferrous deficient Blocks 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 31.76 % and 68.24 % sufficient in the soils tested (Figure 3.26).

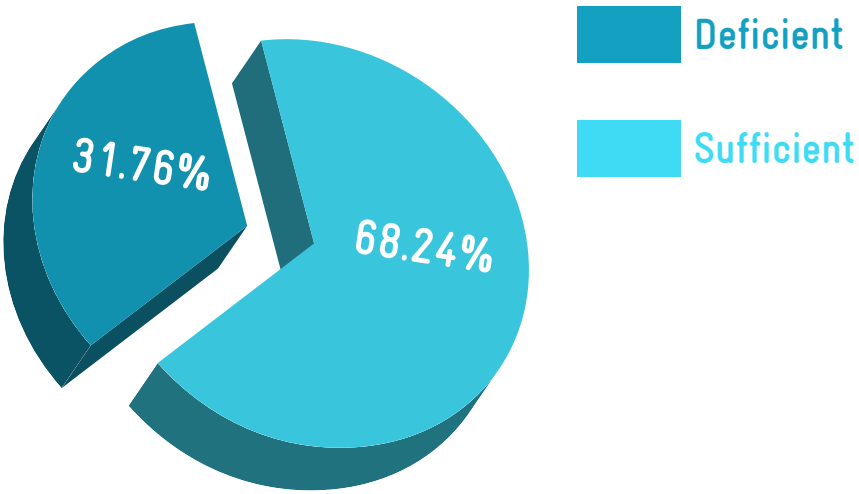


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 75.24 % of the soil is moderately alkaline in nature followed by 14.95 % is moderately acidic while 0.52 % is neutral (Figure 3.27).

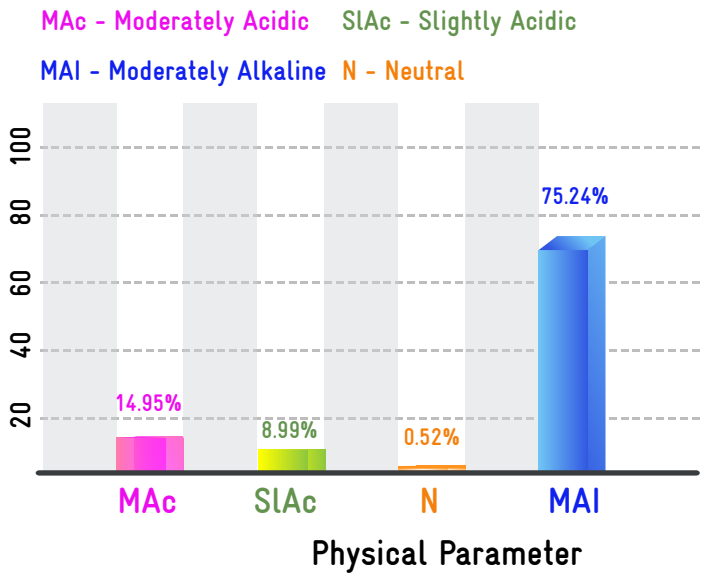


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

A total of 8,946 ha area is used for crop cultivation of which 66.36 % area is irrigated through water sources and remaining area is dependent on rain. Paddy is a major crop with about 76.84 ha of total cultivated area followed by coconut 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.

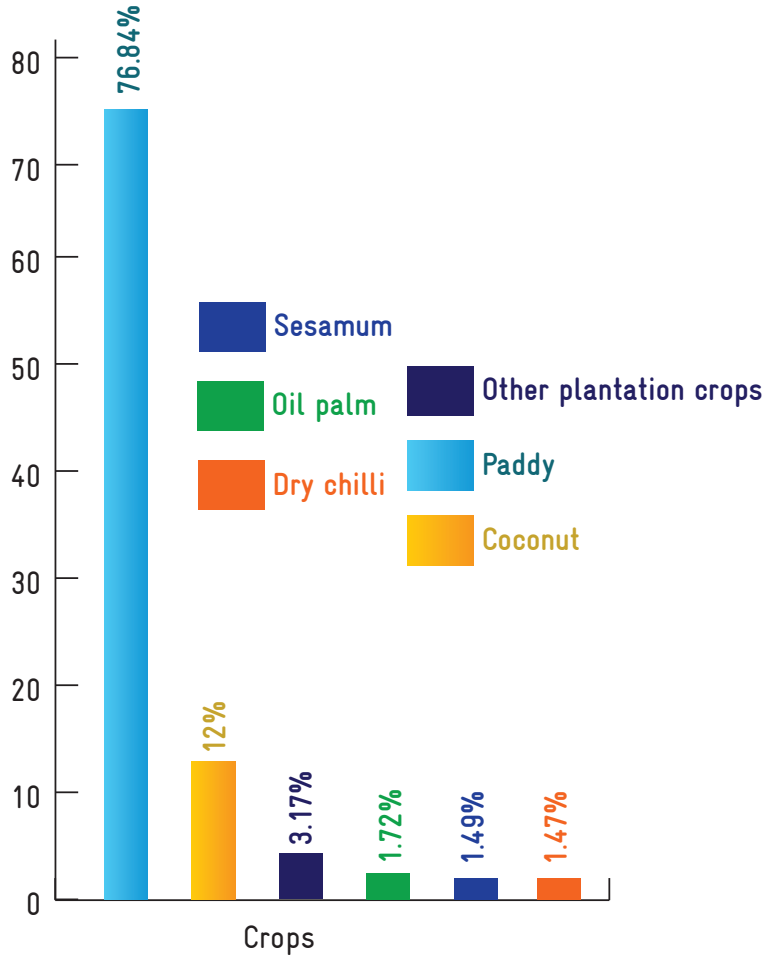


Figure 3.28. Crop pattern (including rain-fed and irrigation area)

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, 79.12 % of the irrigation is done by wild flooding and rest of irrigation is done by control flooding (Figure 3.29).

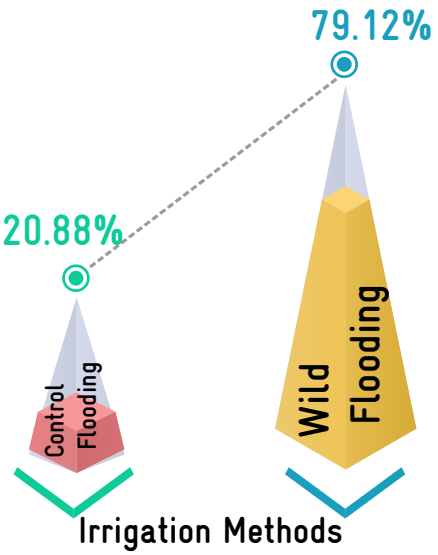


Figure 3.29. Irrigation methods

3.6.2.10 Means of water extraction

Water is extracted in two ways, one by gravity and the other 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, 49.81 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

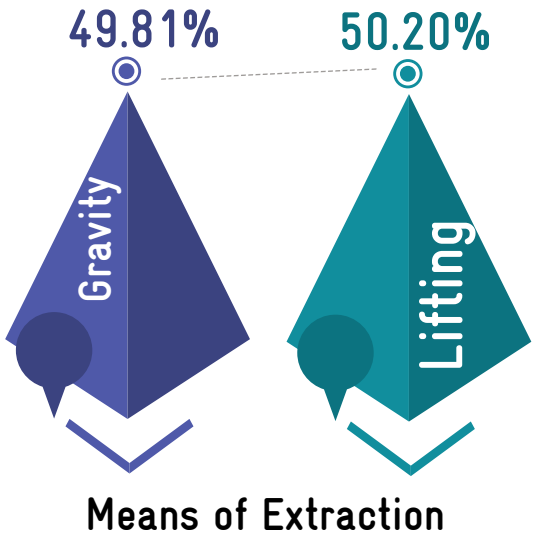


Figure 3.30. Means of water extraction

3.6.2.11 Livestock details

This Block has considerable proportion of livestock resources about 51,724. Of which small ruminants poultry population is high 36.86 % (19,063) followed by goat of 33.79 % (17,476), while cattle population is about 14.68 % (7,593) (Figure 3.31). The total water requirement for livestock is 38.05 ha.m. Of the total water demand of 74.52 % is met through ground water and remaining is from surface water resources.

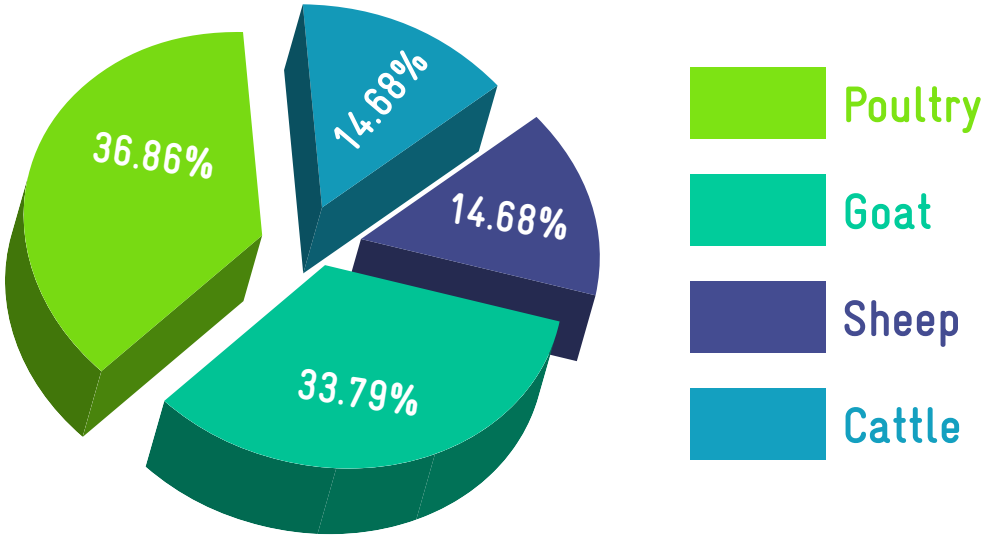


Figure 3.31. Livestock details

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 8 lists the demographic and socio-economic status of Ramanathapuram Block. GP wise demographic and socio-economic status is attached in Annexure 3.11.

TABLE 8. CWRM PARAMETER BASED SOCIO-ECONOMIC STATUS IN THE BLOCK

Parameter	Total
Geographical Area (ha)	27,577.80
Male Population (No.)	43,096
Female Population (No.)	42,204
Total Population (No.)	85,300
SC Population (No.)	22,916
ST Population (No.)	502
Vulnerable population (No.)	23,418
Households (HH's) (No.)	22,157
Only one room HH's (SECC) (No.)	2,466
Female Headed HH's (SECC) (No.)	1,040
Vulnerable Households (SECC) (No.)	2,038
Vulnerable Households (average %)	10.00
Registered MGNREGA Job cards (Persons)	17,390
Active person working in MGNREGA job Cards (Persons)	13,290
Drinking Water Sources (No.)	3,844
HH's have tap water connection for drinking water (No.)	8,523
HH's dependent on other sources for drinking water (No.)	8,027
Annual Greywater Generation (ha.m)	155.67

3.7.1 Population:

The total population of this Block is 85,300 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 27.5 % of the total population are under vulnerable population (Figure 3.32).

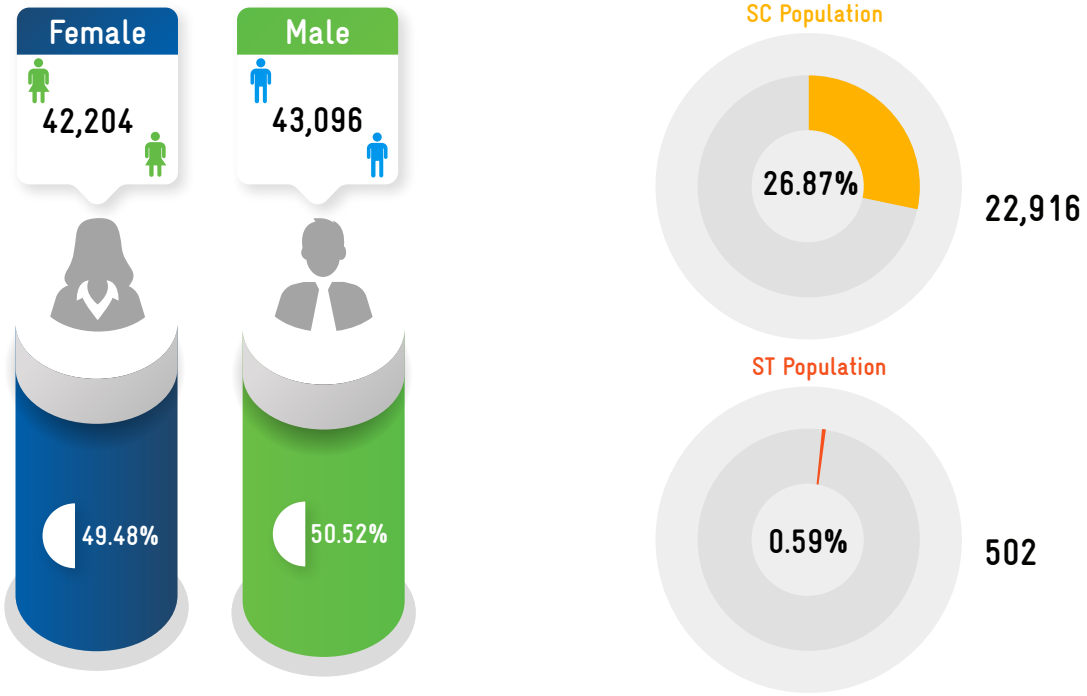


Figure 3.32. Population details

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

3.7.2 Details of households

There are a total of 22,157 households in which 11.13 % households have only one room, 4.69 % households are headed by women and 9.20 % are vulnerable households (Figure 3.33).

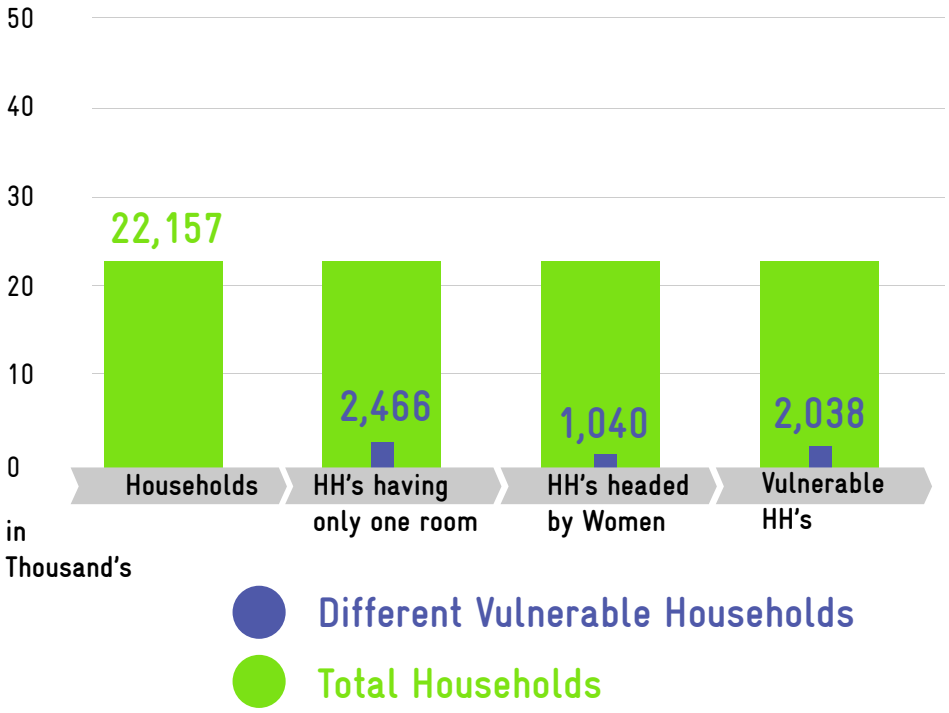


Figure 3.33. Details of households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 85,300, 17,390 are registered for job cards in Mahatma Gandhi NREGA scheme in which 76.42 % of the job cards are in active category (Figure 3.34).

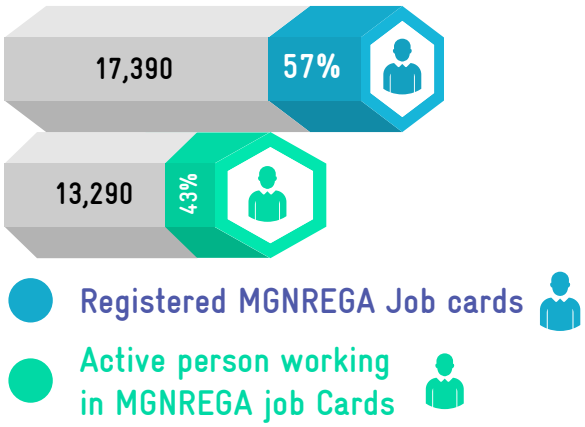


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 8,523 households have tap water connection and 8,027 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

8,523
Households

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

8,027
Households

3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 155.67 ha.m which is available for reuse or recycle.

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

Morphology

Kalanikudi, Chittrakkottai, Devipattinam, Athyuthu

Soil erosion

Karugudi, Karendal, Kavanur

Ground water prosperity

Devipattinam, Naranaman-galam, Therku Tharavai, Toruvalur, Vennathur

Wasteland

Chittrakkottai, Devipattinam, Athyuthu

Physicochemical parameters

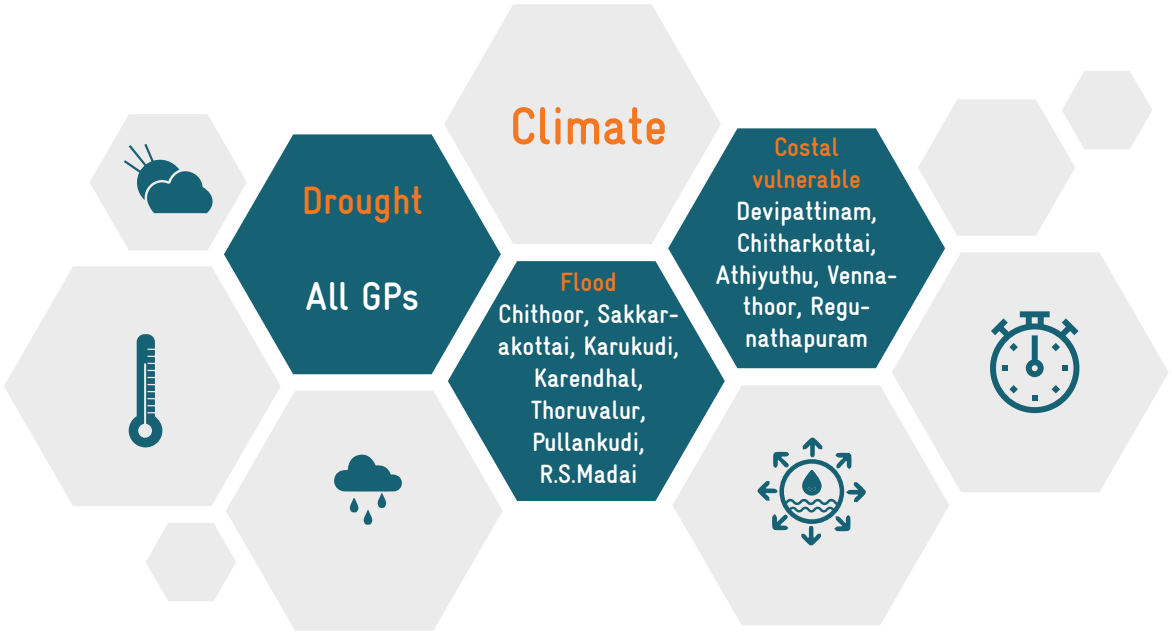
Devipattinam, Madhavanoor, Nagarathamangalam, Toruvalur

Salt affected area

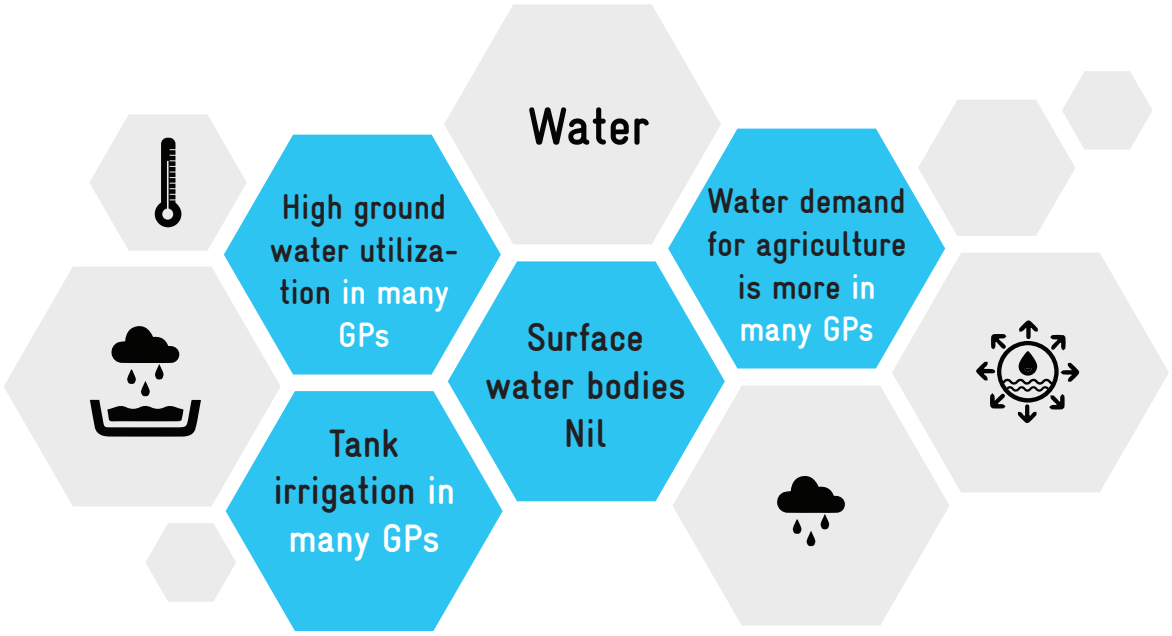
Vennathur, Therku Tharavai, Rajasuriamadai

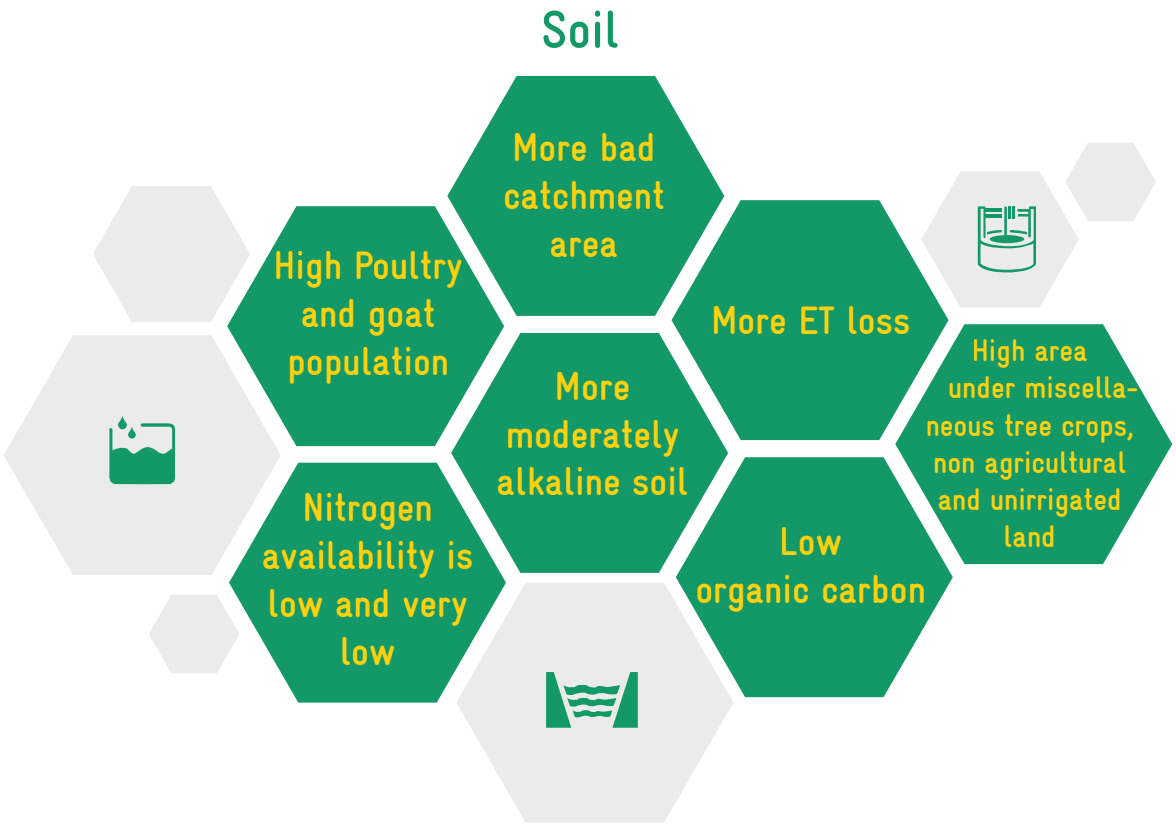
Upland/Slope

Sakkarakottai, Therku Tharavai


Climate
Drought
All GPs
Flood
Chithoor, Sakkarakottai, Karukudi, Karendhal, Thoruvalur, Pullankudi, R.S.Madai
Costal vulnerable
Devipattinam, Chitharkottai, Athiyuthu, Vennathoor, Regunathapuram


Socio economic
Population density high in Sakkarakottai, Madakottan
Vulnerable population high in Surankottai, Paravoor
No. of households and female headed households high in Sakkarakottai, Devipattinam
Total population, Female population high in Devipattinam, Chittrakottai
% of vulnerable households high in Ilamanoor, Pandamangalam, Peruvayal
Grey water generation more in Devipattinam, Chittrakottai
Most of GP HH's have tap water connection for drinking water high in Devipattinam, Sakkarakottai
Registered MGNREGA job cards and active persons working are low in Karukudi, Kalanikudi, Pandamangalam


Water
High ground water utiliza-tion in many GPs
Surface water bodies Nil
Water demand for agriculture is more in many GPs
Tank irrigation in many GPs


Soil
More bad catchment area
High Poultry and goat population
More ET loss
High area under miscella-neous tree crops, non agricultural and unirrigated land
More moderately alkaline soil
Nitrogen availability is low and very low
Low organic carbon

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. Intergovernmental Panel on Climate Change (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).

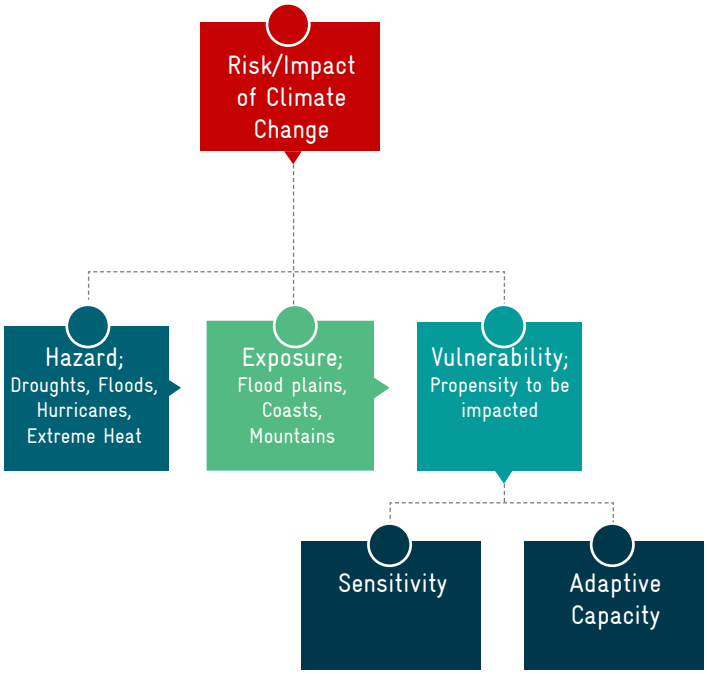


Figure 4.1. Vulnerability of the system as defined by IPCC

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 9 lists CWRM parameters/indicators, its rationale to vulnerability, source of data and its linkage with WASCA TN's primary 18 indicators.

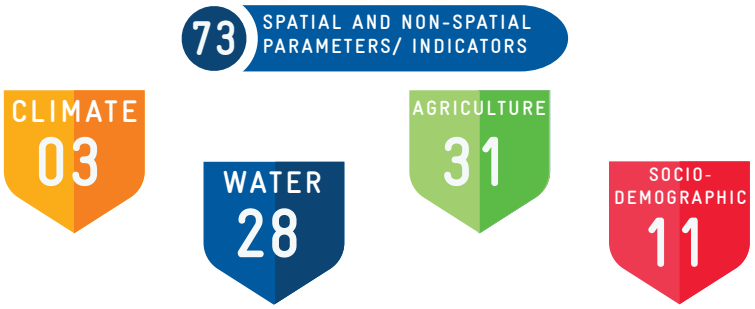


TABLE 9. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

	Key CWRM Parameter	Vulnerability relationship
Climate	Drought	Climate risk/Sensitivity
	Flood locations	
	Heat Wave	
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 Ooranis	
	Other surface waterbodies	
	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 (m)	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	
	Watershed and Drainage Networks	
	Water Quality Index	
	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	

Agriculture	Fallows land other than current fallows	Sensitivity
	Current fallow land	
	Unirrigated land	
	Area irrigated by source	
	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	Population density (persons per ha)	Sensitivity
	Demographic (in %)	
	Female Proportion	Sensitivity
	Vulnerable population Proportion	
	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	

Socio economic	**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. The GPs categorized based on vulnerability scores are shown in Figure 4.2. Kalanikudi, Thoravallur and Puthendal GPs have very high rural water security vulnerability to climate risks followed by Paravoor, Chitoor, Sakkarakottai, Surankottai and Karukudi GPs with high vulnerability. Vennathur GP has very low vulnerability.

Upto	Category	Color range
0.546	Very High	
0.512	High	
0.477	Medium	
0.443	Low	
0.409	Very low	

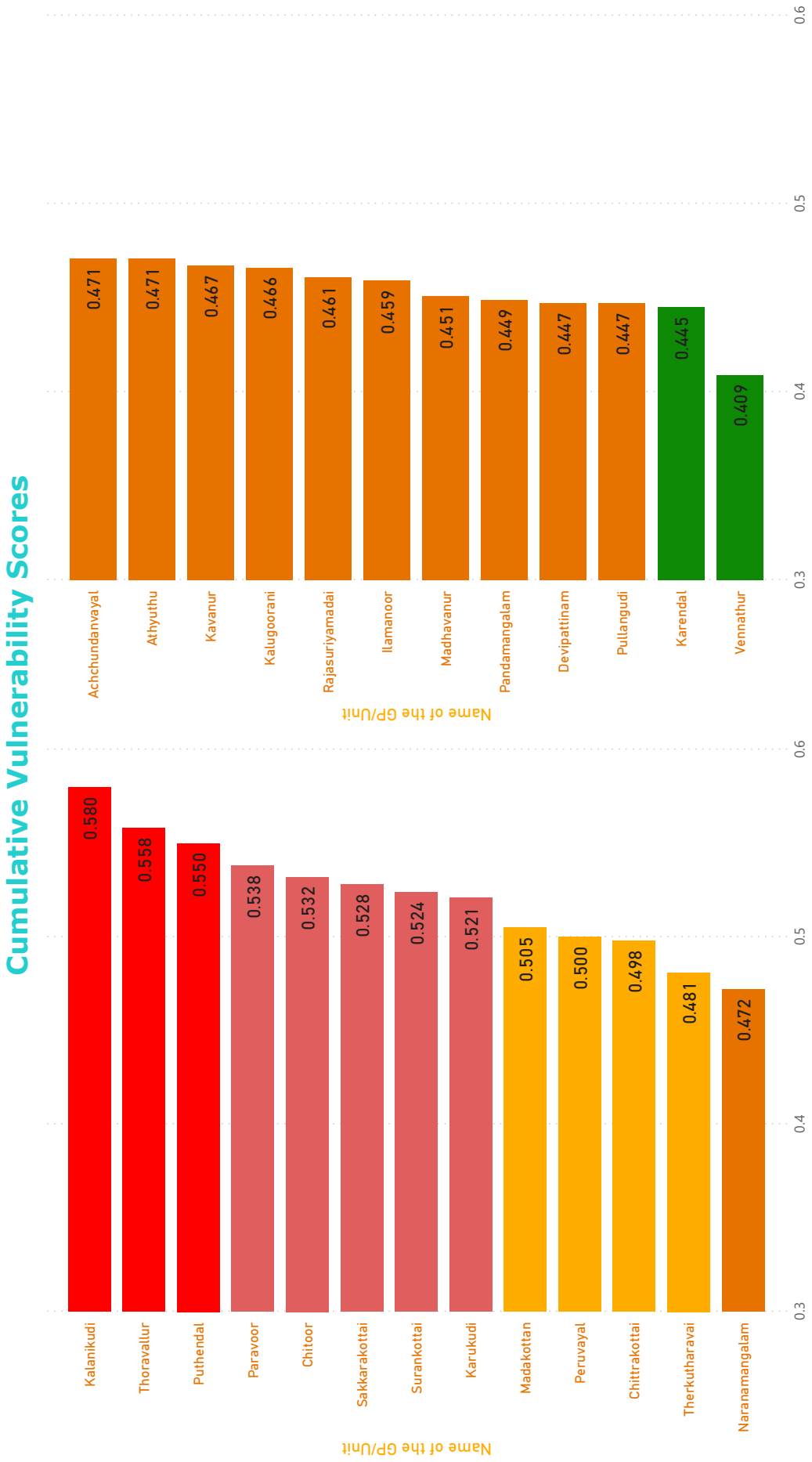


Figure 4.2. Final cumulative vulnerability scores

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. Moderate flood vulnerability are noticed in Chithoor, Sakkarakottai, Karukudi, Karendhal, Thoruvalur, Pullankudi and R.S.Madai GPs.

CHITHOOR, SAKKARAKOTTAI, KARUKUDI, KARENDHAL, THORUVALUR, PULLANKUDI, R.S.MADAI

Coastal vulnerability hot spots

Devipattinam, Chitharkottai, Athiyuthu, Vennathoor and Regunathapuram GPs

DEVIPATTINAM, CHITHARKOTTAI, ATHIYUTHU, VENNATHOOR, REGUNATHAPURAM

Water resource vulnerability

The water resources vulnerability index shows that Rajasuriyamadai, Chittrakottai and Madhavanur GPs have high vulnerability

RAJASURIYAMADAI, CHITTRAKOTTAI, MADHAVANUR

Agriculture resources vulnerability

In agriculture and allied sectors, Surankottai, Rajasuriyamadai, Kalugoorani, Thoravallur, Chittrakottai and Kavanur GPs have high vulnerability

SURANKOTTAI, RAJASURIYAMADAI, KALUGOORANI, THORAVALLUR, CHITTRAKOTTAI, KAVANUR

Socio-economic vulnerability

Peruvayal, Paravoor, Pandamangalam, Chitoor GPs have high socio economic vulnerability

PERUVAYAL, PARAVOOR, PANDAMANGALAM, CHITOOR

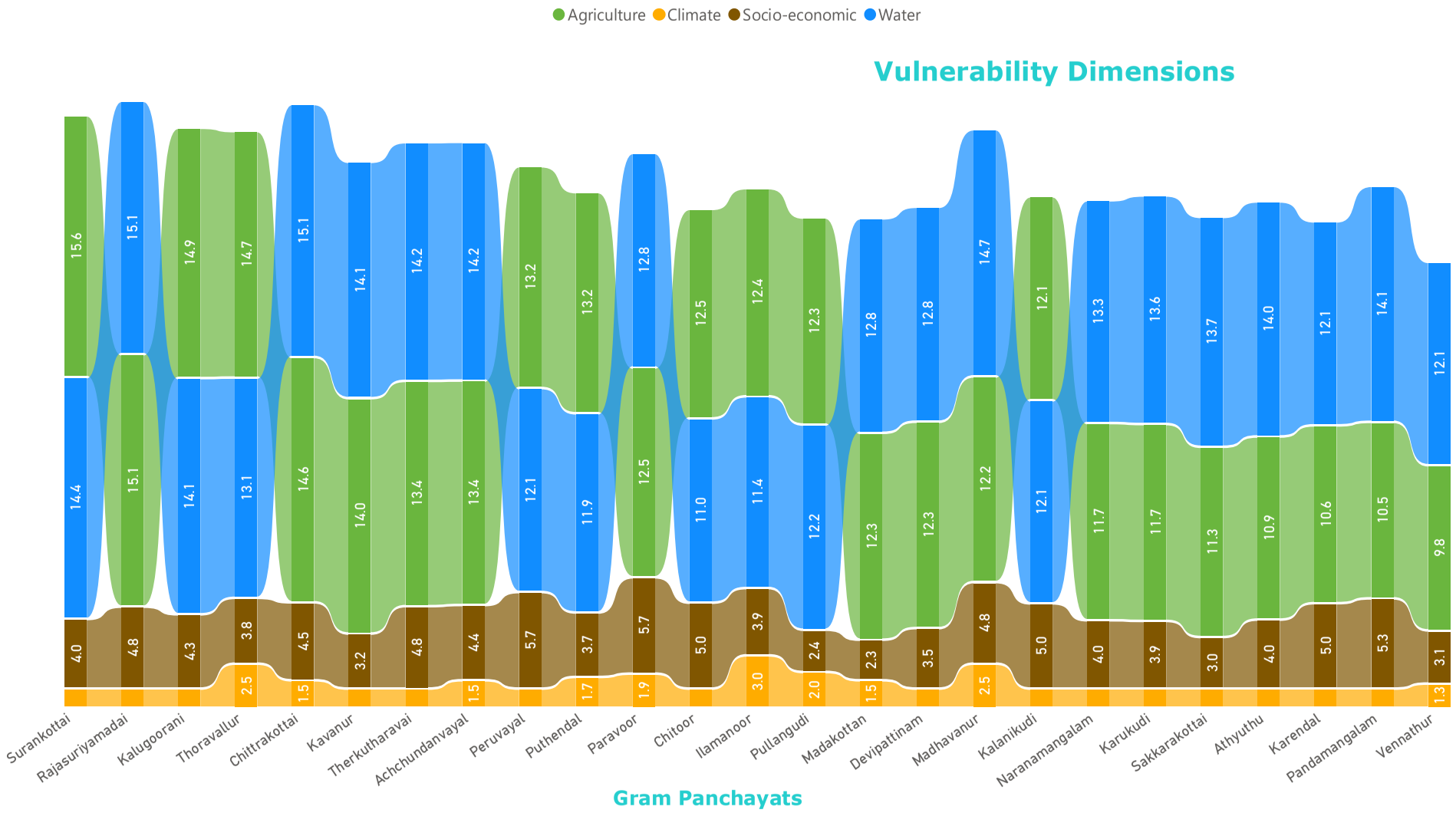
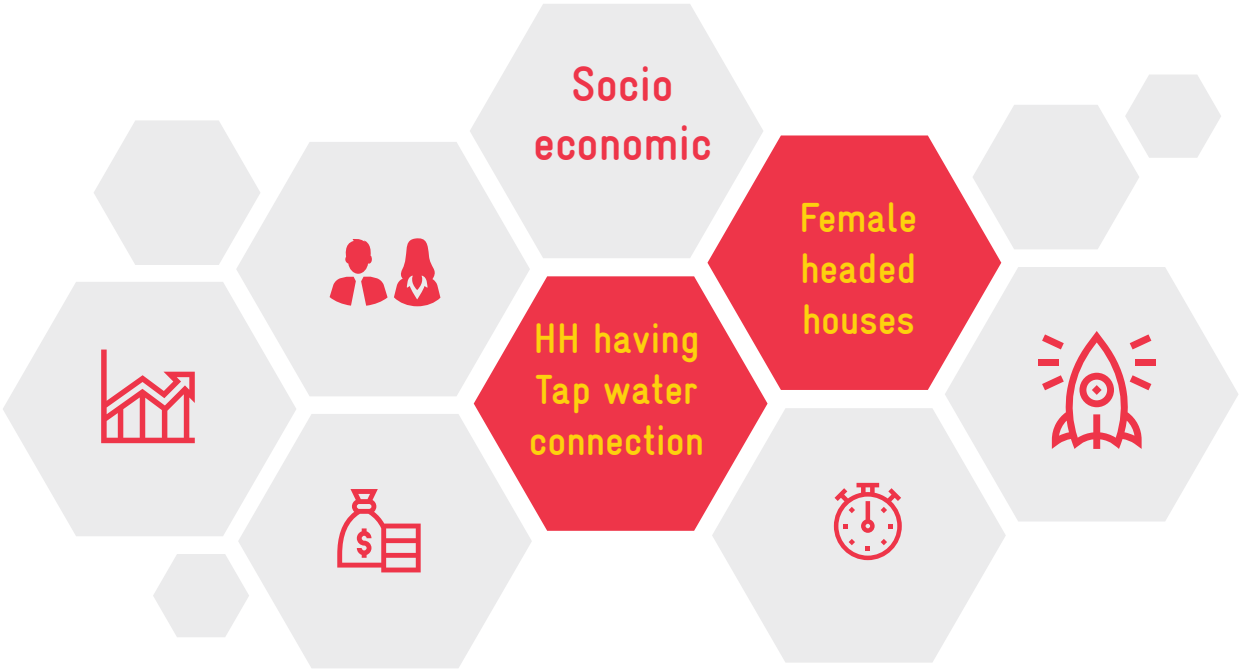
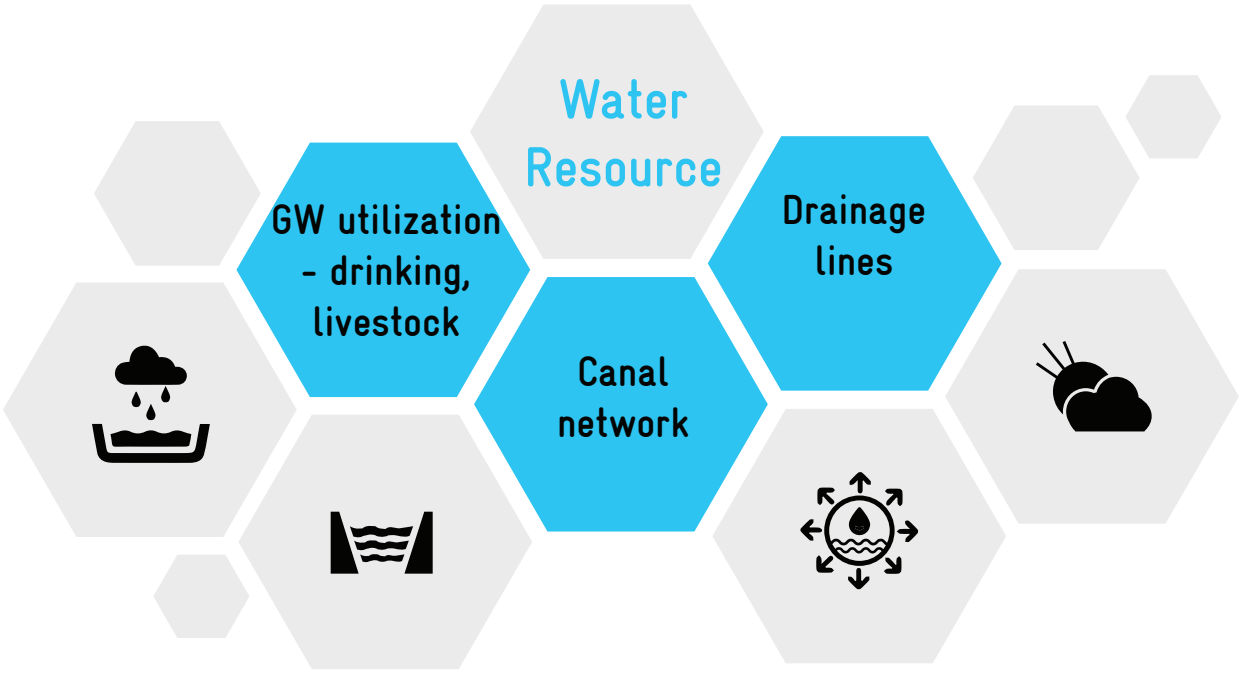
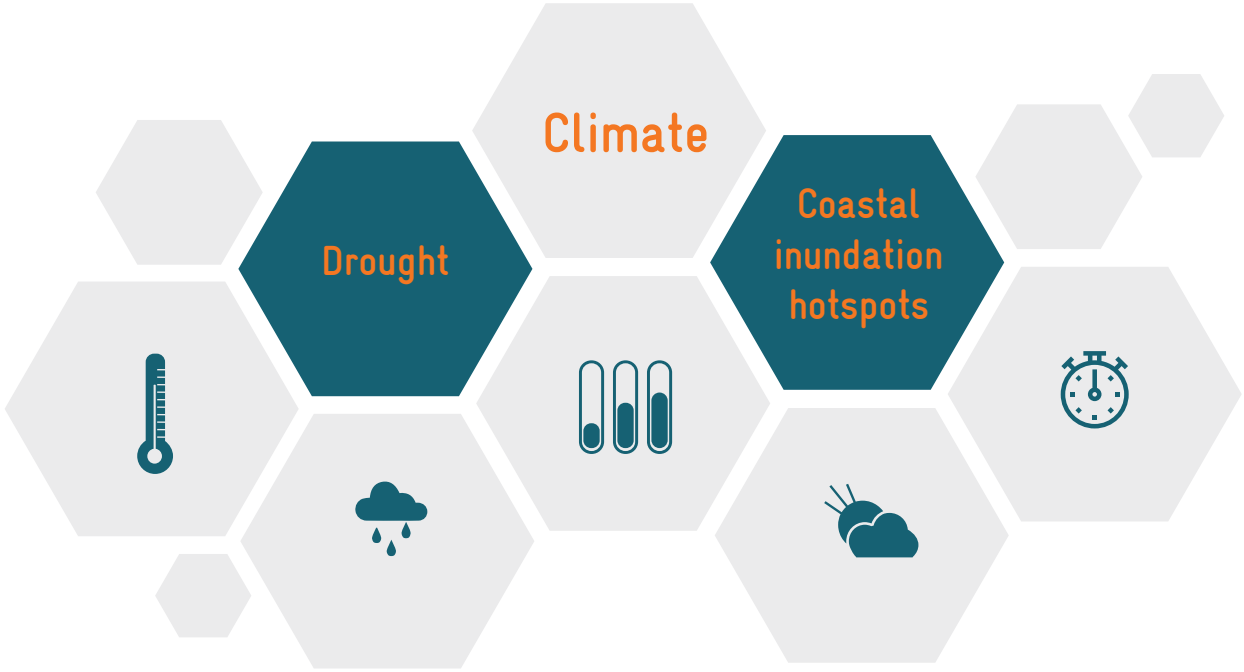


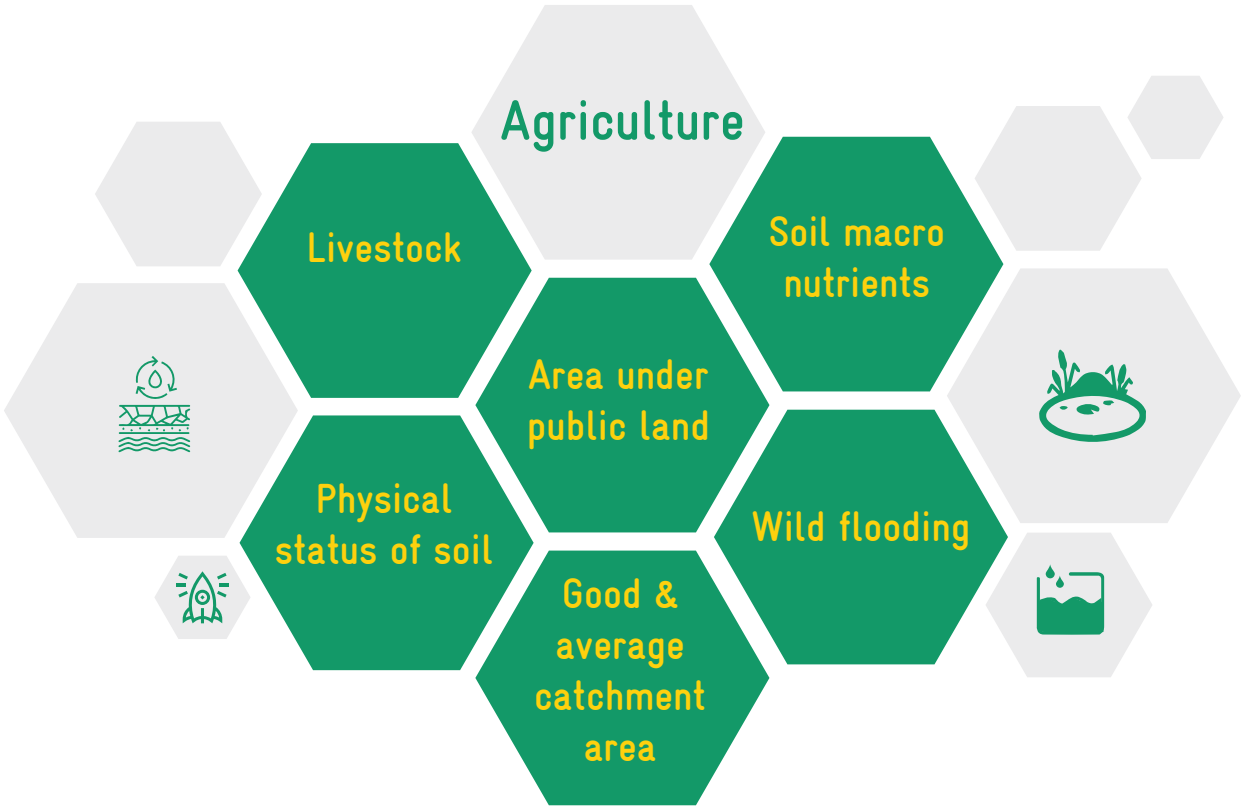
Figure 4.3. GP wise vulnerability dimensions

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

PROPOSED KEY WATER ACTIONS 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). Proposed works on watershed and livelihood approach shown in Annexure 5.3.

5.1 THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 28,035.42 ha available land in Ramanathapuram Block, 10,705.27 ha (38.14 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 6,911.84 ha of land under miscellaneous tree crops (64.56 % of total proposed area), followed by 1,512.84 ha of barren and un-cultivable land (14.3 % of total proposed area) while least of 44.84 ha 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 10 and Figure 5.1. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 10. THE PROPOSED AREA FOR WASCA TREATMENT

Land use	Total available land (ha)	WASCA proposed treatment area (ha)
Area Irrigated by Source	4,935.25	538.40
Barren & Un-cultivable Land	1,779.80	1,512.84
Cultivable Waste Land	707.62	601.51
Current Fallow land	2,133.33	227.73
Fallows Land other than Current Fallows	436.59	44.84
Land Under Miscellaneous Tree Crops etc.	8,131.59	6,911.84
Non-Agricultural Uses	4,842.41	229.99
Unirrigated Land	5,068.83	638.12

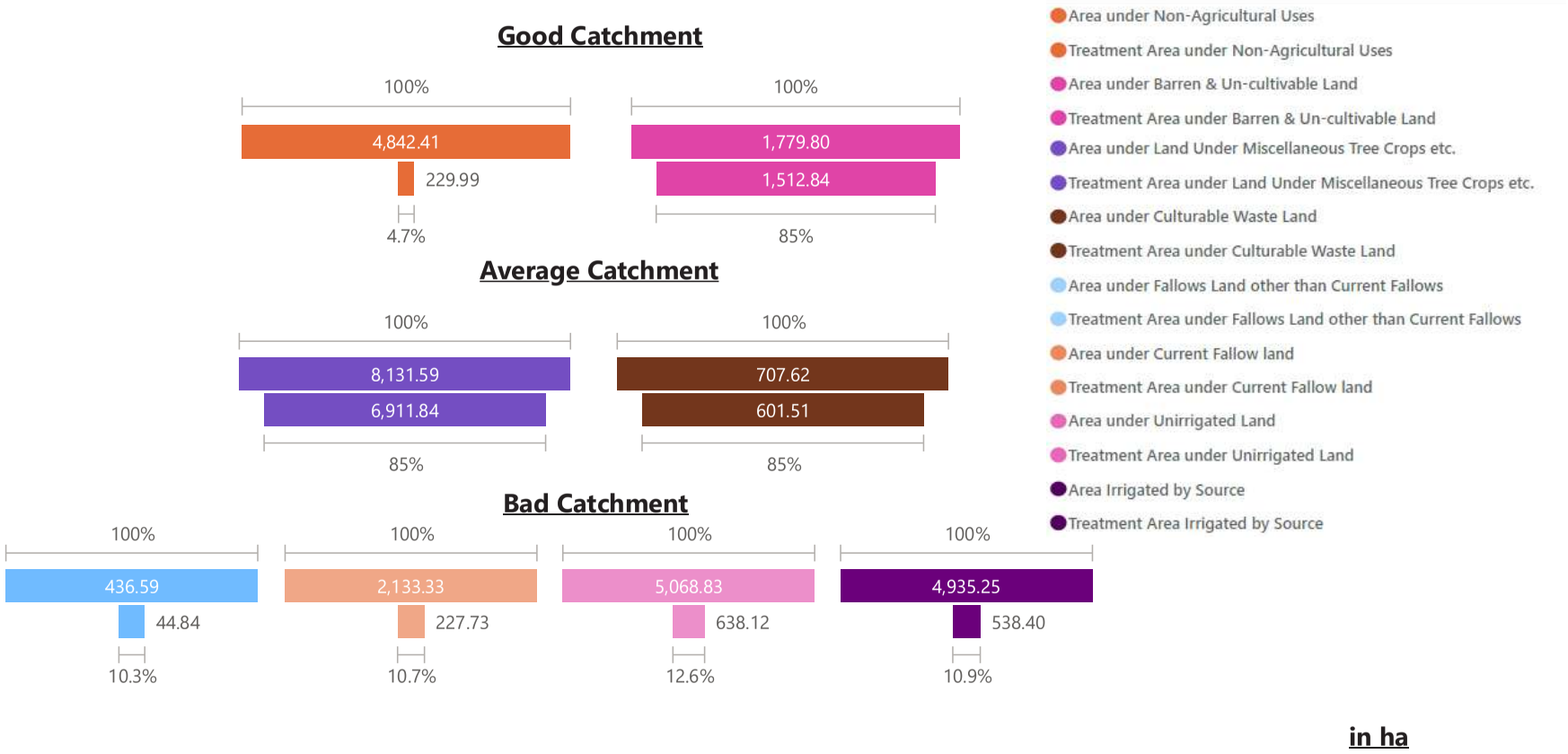


Figure 5.1. WASCA treatment area in percentage

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 1,892 ha.m which is 42.96 % of the total runoff. Of the expected runoff conservation, the highest of 62.97 % from average catchment area was considered for treatment followed by 33.08 % of good and rest from bad catchment area (Figure 5.2).

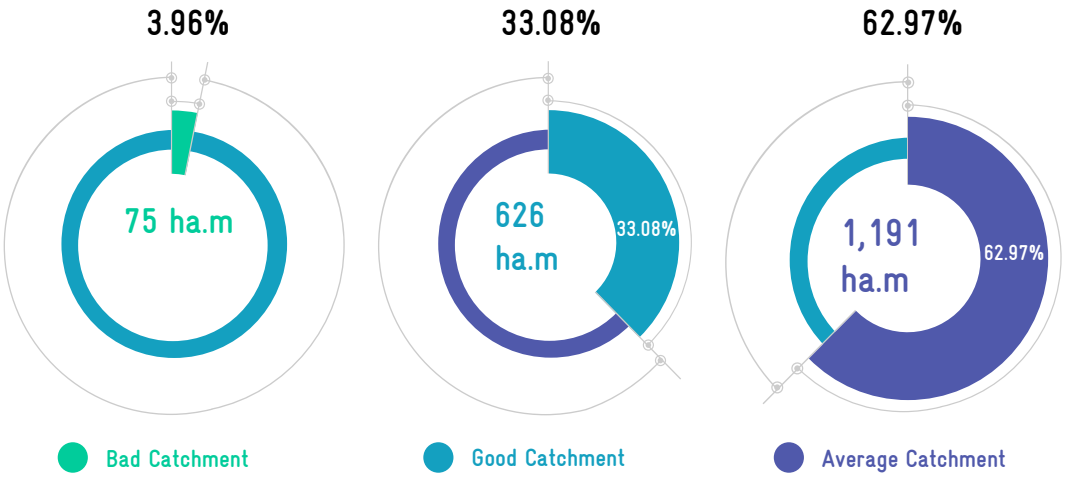


Figure 5.2. Expected conservation after WASCA treatment

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. GP wise works are annexed in annexed in Annexure 5.3.

Work (unit)	Abbreviation (unit)	No.	Extent (area in ha or length in m)
Azolla units - Individual (Number of units)	Az	191	1,896
Cattle Shelters (Number of units)	CS	191	1,896
Cattle Trough(Number of units)	CT	191	1,896
Fodder development - Community & Individual	FD	191	1,896
Goat Sheep Shelters (Number of units)	GSS	1,733	17,352
Poultry Shed (Number of units)	PS	426	4,258
Silvi-pasture Development (ha)	SPD	-	-
Soak Pits (Community) (Number of units)	SPC	209	20,604
Soak Pits (Individual) (Number of units)	SPI	2,061	20,604
Artificial Recharge Structure(Number of units)	ARS	667	1,669
Construction of Farm Ponds - Individual (Number of units)	FP	363	1,449

Restoration of water bodies:PWD and Union Tanks(Number)	RPWDT	53	
Restoration of water bodies: Ooranis(Number)	Roo	232	
Restoration of water bodies:Ponds(Number)	RP	-	
Roof Rain Water Harvesting (Number of units)	RRWH	50	
Water Course - Irrigation Channels - Desilting (Mtrs)	WCICD	29,539	
Afforestation in Public/common lands(ha)	Aff	12,89,170	1,743
Avenue plantation(km)	AVP	20,318	81,261
Block Plantation (Community)(ha)	BP	55,30,495	7,513
Canal Bund Plantation(ha)	CBP	6,579	26,313
Contour Continuous Bunds (CCB) for Afforestation area(Mtrs)	CCBF	3,48,565	1,743
Drainage Line Treatment (Mtrs)	DLT	20,104	80,409
Dry land Horticulture/Agro-forestry - Individual (ha)	DLHAI	290	724
Irrigation Channel Plantation (Mtrs)	ICP	7,386	29,539
Linear Plantation(km)	LP	10,319	41,275
Micro Irrigation(ha)	MI	216	538
Nursery Development (Number of units)	ND	1,03,020	20,604
Composting(Number of units)	Co	371	1,449
Farm Bunding with Boundary Trenches - Individual (ha)	FBBTI	580	1,449
Land development - Individual (ha)	LDI	188	455
NADEP Vermi compost (Number of units)	NADEP	191	1,896


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 5,249 ha area
More than 73.21 Lakhs plants planting
1,300 sites for WCWH
4,620 livelihood works

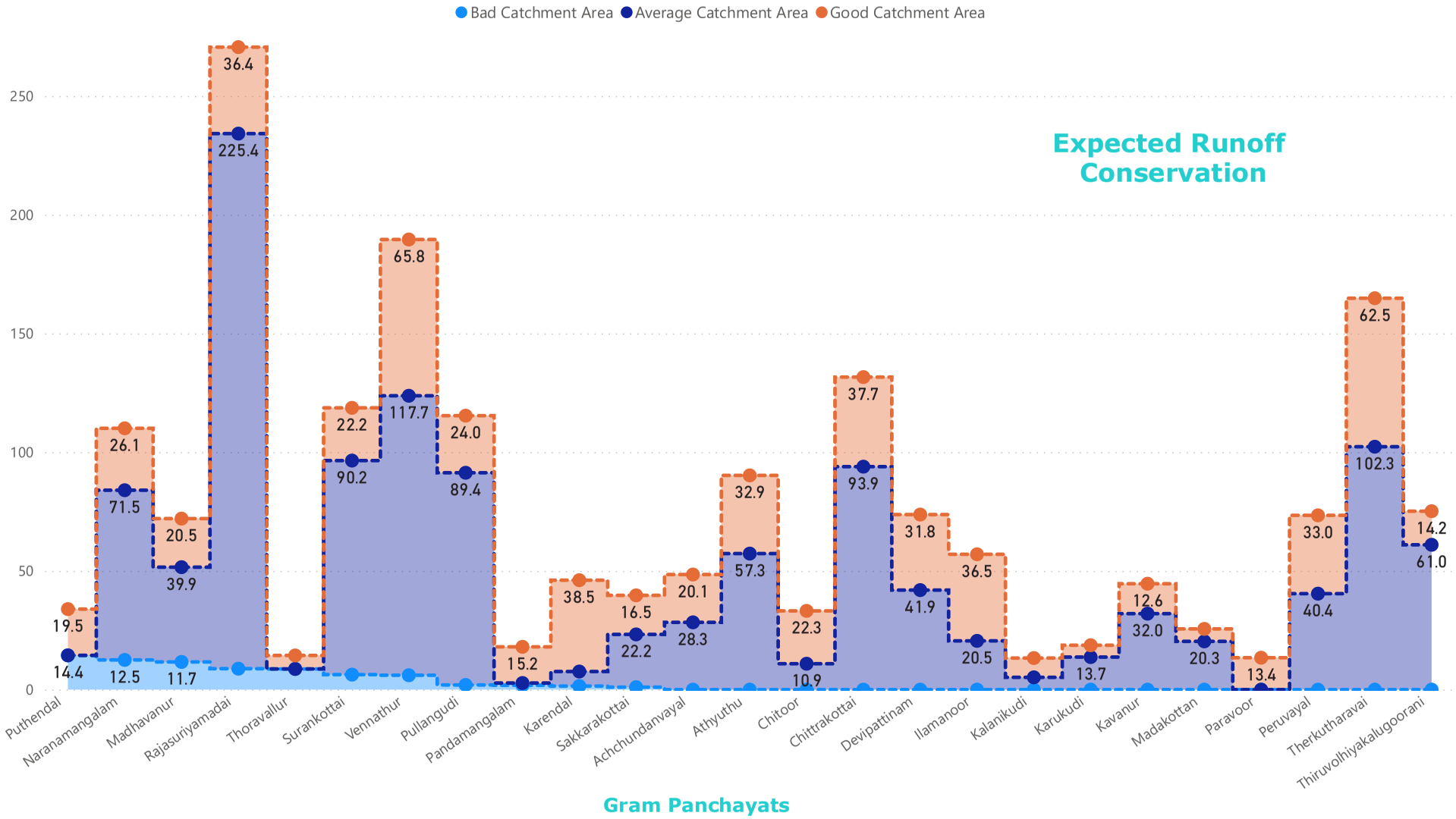


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

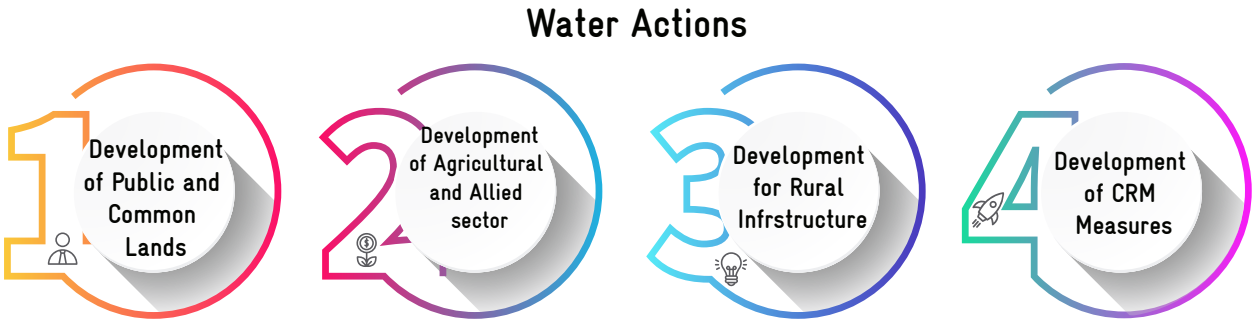
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

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 4 categories through Mahatma Gandhi NREGS 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 11 and Figure 5.4.

DEVELOPMENT OF PUBLIC AND COMMON LANDS

TABLE 11. 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)	6,971	10	0.025	174.28	69,713
COMPOSTING (NUMBER OF UNITS)	371	15	0.17	63.07	5,565
AFFORESTATION IN PUBLIC/ COMMON LANDS (ha)	1,743	3,344	8.6	14,989.80	58,28,592
BLOCK PLANTATION (COMMUNITY) (ha)	7,513	4,320	11.1	83,394.30	3,24,56,160
SILVI-PASTURE DEVELOPMENT (ha)	-	6,664	17.1	-	-
LINEAR PLANTATION (km)	41	703	1.8	74.30	29,016
CANAL BUND PLANTATION (ha)	404	2,930	7.5	3,030.60	11,83,954
IRRIGATION CHANNEL PLANTATION (m)	15,004	6	0.015	225.06	90,024
AVENUE PLANTATION(km)	81	703	1.8	146.27	57,126
NURSERY DEVELOPMENT (NUMBER OF UNITS)	515	2,344	15	7,726.50	12,07,394
RESTOTARATION OF WATER BODIES: PWD AND UNION TANKS (NUMBER)	57	800	5	285	45,600
RESTORATION OF WATER BODIES: OORANIS (NUMBER)	239	200	2	478	47,800
RESTORATION OF WATER BODIES: PONDS (NUMBER)	4	200	1	4	800
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	378	391	2.5	945	1,47,798
WATER COURSE - IRRIGATION CHANNELS - DESILTING (M)	15,004	3	0.0075	112.53	45,012
DRAINAGE LINE TREATMENT (m)	2,010	5	0.03	60.31	10,052

COASTAL WATERSHED WORKS					
NURSERY DEVELOPMENT - COASTAL PLANTATION (NUMBER OF UNITS)	-	7,813	20	-	-
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)	833	2,930	0.1875	156.24	24,41,569
WETLAND PLANTATION (INNER) (ha)	-	2,930	7.5	0.03	10
COASTAL WETLAND - BUND STRENGTHENING (km)	4,624	977	0.0625	288.97	45,17,160
WETLAND INLET IMPROVEMENT WORKS (NUMBER OF UNITS)	181	3,906	10	1810	7,06,986
CHECK DAM FOR CONTROLLING SEA WATER INTRUSION (NUMBER OF UNITS)	-	234	1.5	-	-
CONSTRUCTION OF FISH DRYING YARD (NUMBER OF UNITS)	-	331	2.12	-	-
AGRO FORESTRY IN INDIVIDUAL LANDS (ha)	66	2,930	7.5	495	1,93,380

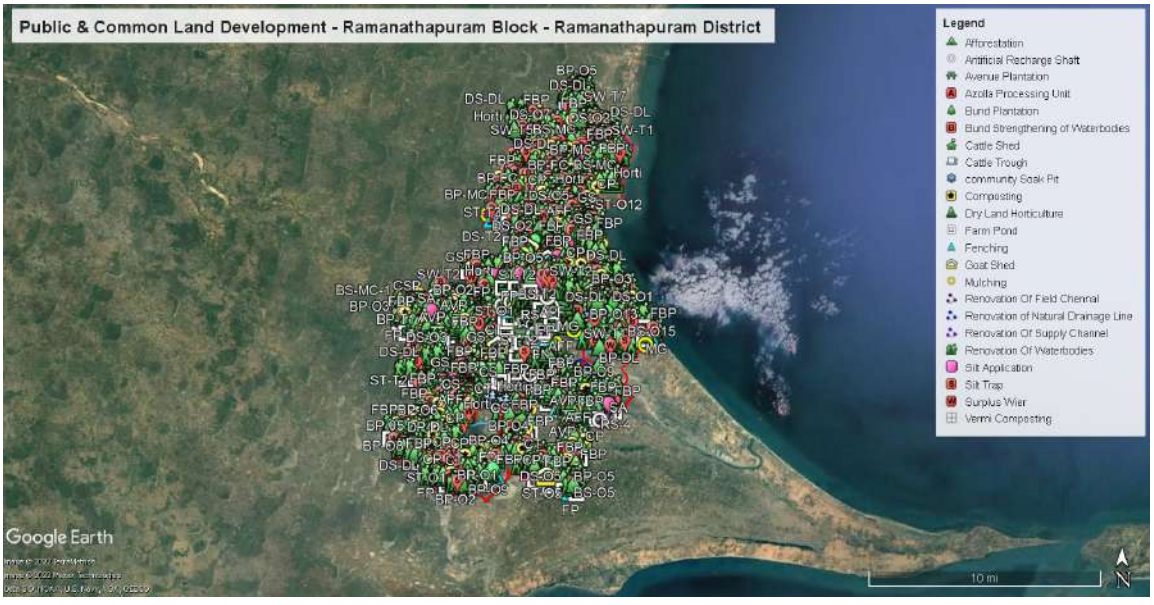


Figure 5.4. Proposed development activities in Public and Common land

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 12 & Figure 5.5).

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

TABLE 12. 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)	1,449	586	1.5	2,173.50	8,49,114
MICRO IRRIGATION (ha)	216	-	1	216	-
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	363	781	2	726	2,83,503
LAND DEVELOPMENT - INDIVIDUAL (ha)	455	3,906	10	4,550	17,77,230
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	724	3,321	8.5	6,154	24,04,404
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	191	23	0.15	28.65	4,393
NADEP VERMI-COMPOST (NUMBER OF UNITS)	191	27	0.18	34.38	5,157
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	191	2,344	1.48	282.68	4,47,704
CATTLE SHELTERS (NUMBER OF UNITS)	191	331	2.12	404.92	63,221
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	1,733	355	2.27	3,933.91	6,15,215
CATTLE TROUGH (NUMBER OF UNITS)	191	6	0.05	9.55	1,146
POULTRY SHED (NUMBER OF UNITS)	426	10	0.09	38.34	4,260

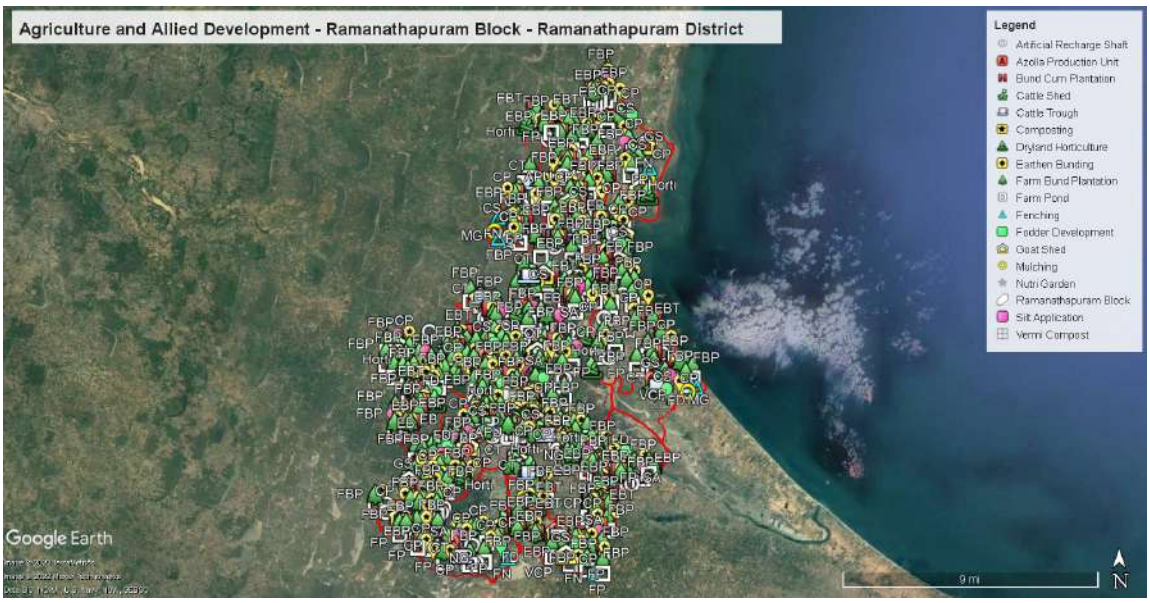


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.4 DEVELOPMENT OF RURAL INFRASTRUCTURE

The prominent works on constructing structures for water harvesting and grey water management are proposed as in Table 13 and Figure 5.6.

DEVELOPMENT OF RURAL INFRASTRUCTURE

TABLE 13. 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)	209	20	0.13	27.17	4,180
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	2,061	16	0.1	206.10	32,976
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	50	625	4	200	31,250
TANKA - COMMUNITY LEVEL (NUMBER OF UNITS)	-	300	30	-	-

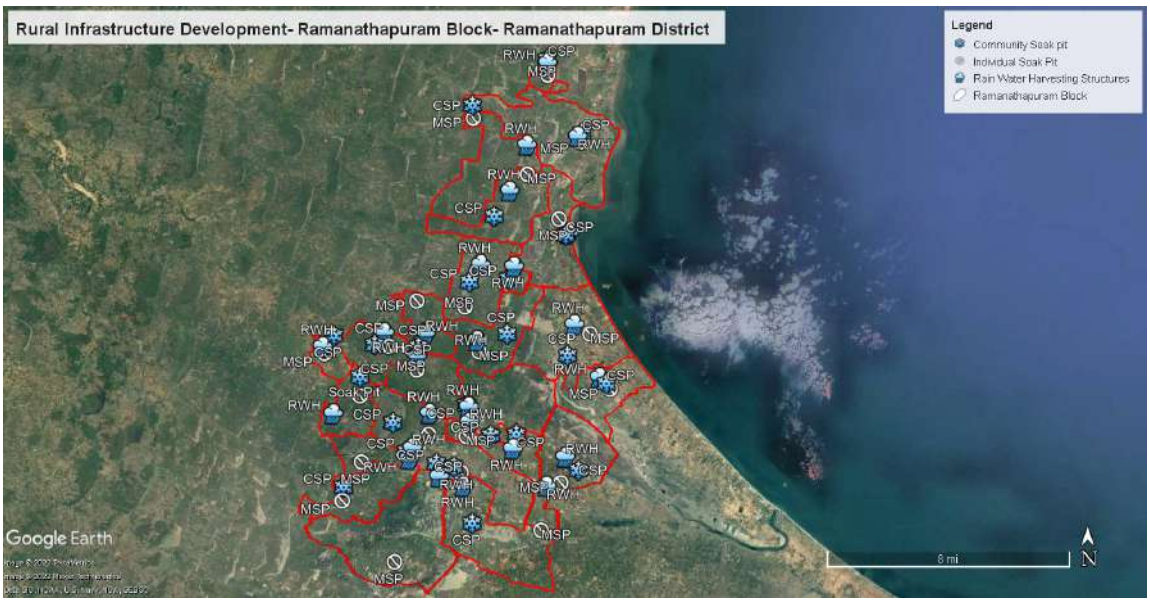


Figure 5.6. Proposed Rural Infrastructure activities

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 (Table 14). Measures such as farm ponds (Table 15), horticulture park (Table 16), mega forest (Table 17), avenue plantation (Table 18), mini forest (Table 19), Tanka (Table 20), and Nursery development (Table 21) were proposed in this Block in saturation mode. Among the activities mini forest works are more in number (76) followed by tanka (31).

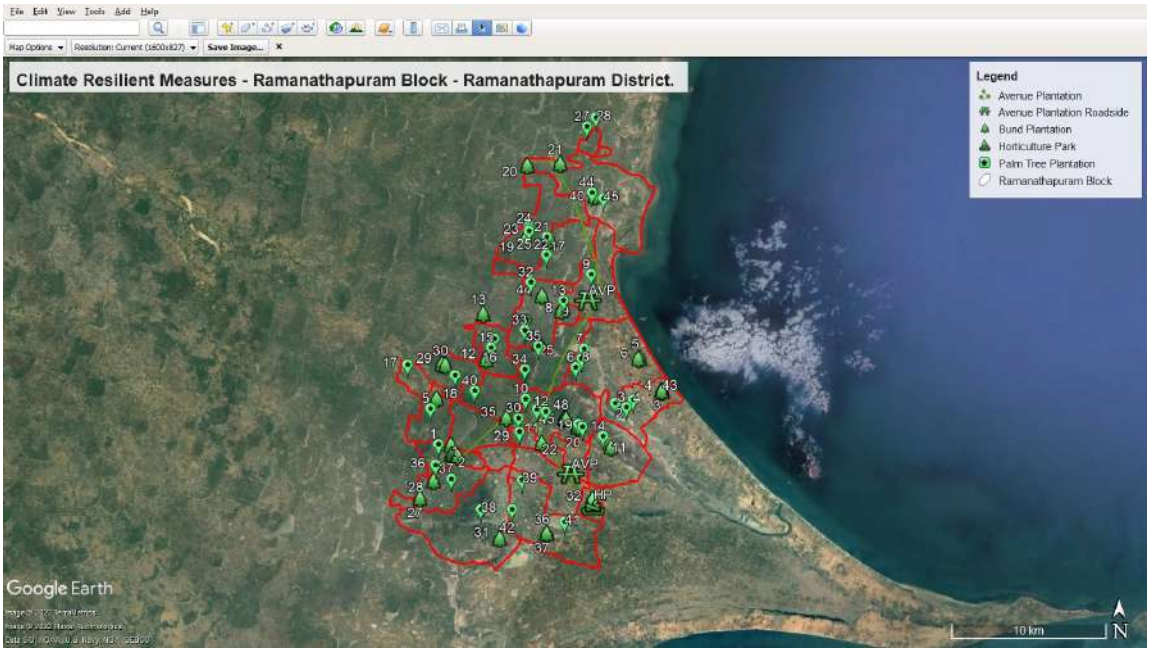


Figure 5.7. Proposed climate resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Agriculture and allied activities	Public and common land	Rural infrastructure
Achchundanvayal			Tanks
Achunthanvayal	Mega forest		
	Mini forest		
Athiyuthu	Mini forest	Nursery development	Tanks
Chitharkottai	Mini forest	Nursery development	
Chithoor	Mini forest	Nursery development	Tanks
Chittrakkottai			Tanks
Devipattinam		Nursery development	Tanks
Ilamanoor	Mega forest	Nursery development	Tanks
	Mini forest		
Kalanikudi	Mini forest	Nursery development	Tanks
Kalugoorani	Mega forest	Nursery development	
	Mini forest		
Karendhal	Mini forest	Nursery development	Tanks
Karugudi		Nursery development	Tanks
Kavanoor	Mini forest	Nursery development	Tanks
Madakkottan	Mini forest	Nursery development	
Madhavanur	Mega forest	Nursery development	
	Mini forest		
Mathavanoor			Tanks
Naranamangalam	Mini forest	Nursery development	Tanks
Pandamangalam	Mini forest	Nursery development	Tanks
Peravoor		Nursery development	Tanks
Peravur	Mini forest		
Peruvayal	Mini forest	Nursery development	Tanks
Pullankudi	Mini forest	Nursery development	Tanks
Puthendhal	Mini forest	Nursery development	Tanks
Rajasooriyamadai	Avenue plantation	Nursery development	Tanks
	Mini forest		
Sakkarakkottai	Mega forest	Nursery development	
	Mini forest	Horticulture Park	
Therkutharavai	Avenue plantation	Nursery development	
	Mini forest		
	Mega forest		
Thoruvaloor	Mini forest	Nursery development	
Vennathoor	Mini forest	Nursery development	

TABLE 15. DETAILS OF PROPOSED FARM PONDS ACTIVITY UNDER CRM

Block Target	Community Farm Ponds	Community Farm Ponds Completed	Individual Farm Ponds	Individual Farm Ponds Completed
153	99	99	54	54

TABLE 16. DETAILS OF PROPOSED HORTICULTURE PARK ACTIVITIES UNDER CRM

GP	Area for Plantation (in ha)	No. of Plants (1 ha – 10,000 saplings)	Land type
Sakkarakottai	0.50	500	**Govt./Purampok-ku**

TABLE 17. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (in ha)	No. of Plants (1 ha – 10,000 saplings)	Labour (L)	Total Person days	Classification of land
Achunthanvayal	0.5	5,000	13,98,492	5,463	**Govt. Purampokku land**
Therkutharavai	1	10,000	27,96,984	10,926	
Kalugoorani	1	10,000	27,96,984	10,926	
Sakkarakottai	1	10,000	27,96,984	10,926	
Ilamanoor	0.5	5,000	13,98,492	5,463	
Madhavanur	0.5	5,000	13,98,492	5,463	
Total	**4.5**	**45,000**	**1,25,86,428**	**49,167**	

TABLE 18. DETAILS OF PROPOSED AVENUE PLANTATION ACTIVITY UNDER CRM

GP	Road Length (in km)	Area of plantation (in ha)		Total No. of Plants	Classification of Land
		Number of Big Trees	Number of Small Trees		
Therkutharavai	4.18	418	836	1,258	**Govt Puram-pokku land**
Rajasuriyamadai	4.04	404	808	1,216	
Total	**8.22**	**822**	**1,644**	**2,474**	

TABLE 19. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area in ha	No. of Plants (1 ha – 10,000 saplings)	MGNREGA (INR in Lakhs)			Person days
			Labour	Materials	Total	
Achunthanvayal	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Athiyuthu	0.2	2,000	6,22,196	27,804	6,50,000	2,432
Chitharkottai	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Chithur	0.05	500	1,55,549	6,951	1,62,500	608
Ilamanoor	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Ilamanur	0.35	3,500	10,88,843	48,657	11,37,500	4,256
Kalanikudi	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Kalugurani	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Karendhal	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Kavanur	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Madakottan	0.3	3,000	9,33,294	41,706	9,75,000	3,648
Madhavanur	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Naranamangalam	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Pandamangalam	0.05	500	1,55,549	6,951	1,62,500	608
Peravur	0.05	500	1,55,549	6,951	1,62,500	608
Peruvayal	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Pullankudi	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Puthenthal	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Rajasuriyamadai	0.05	500	1,55,549	6,951	1,62,500	608
Sakkarakottai	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Surankottai	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Therkutharavai	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Thoruvalur	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Vennathur	0.1	1,000	3,11,098	13,902	3,25,000	1,216
Total	**2.75**	**27,500**	**85,55,195**	**3,82,305**	**89,37,500**	**33,440**

TABLE 20. DETAILS OF PROPOSED TANKAS ACTIVITY UNDER CRM

Sl. No.	GP
1	Achchundanvayal
2	Athyuthu
3	Chithoor
4	Chittrakkottai
5	Devipattinam
6	Ilamanoor
7	Kalanikudi
8	Karendal
9	Karugudi
10	Kavanur
11	Mathavanoor

12	Naranamangalam
13	Pandamangalam
14	Peravoor
15	Peruvayal
16	Pullangudi
17	Puthenthal
18	Rajasuriamadai
19	Sakkarakottai
20	Surankottai
21	Therku Tharavai
22	Toruvalur
23	Vennathur

TABLE 21. DETAILS OF PROPOSED NURSERY DEVELOPMENT ACTIVITY UNDER CRM

Sl. No.	GP	Total No. of Plants
1	Achundanvayal	
2	Athiyuthu	
3	Chitharkottai	
4	Chithoor	
5	Devipattinam	
6	Ilamanoor	
7	Kalanikudi	
8	Kalugoorani	
9	Karendhal	
10	Karugudi	
11	Kavanoor	
12	Madakkottan	
13	Madavanoor	1,000 plants in each GP
14	Naranamangalam	
15	Pandamangalam	
16	Peravoor	
17	Peruvayal	
18	Pullangudi	
19	Puthendhal	
20	Rajasooriyamadai	
21	Sakkarakkottai	
22	Surankottai	
23	Therkutharavai	
24	Thoruvaloor	
25	Vennathoor	
	Total	**25,000**

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

6 PROJECTED OUTCOMES OF PLANNING

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	10,705 ha (38.18 %) of the total area treated under WASCA
2	Percentage reduction of run off	1,892 ha.m i.e 42.96 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	300 waterbodies (tanks/pond and Ooranis) restored
4	Area under afforestation	1,743 ha area under afforestation
5	Length of drainage line treated	80.5 km length of drainage line treated
6	Canal Bund Plantation	More than 80 thousand plants through 404 works
7	Nursery development	515 units

10,705 ha
AREA TREATED

1,892 ha.m
TOTAL RUNOFF HARVESTED

300
WATER BODIES RESTORED

1,743 ha
AREA AFFORESTATION

80.5 km
DRAINAGE LINE TREATED

80,000
PLANTS

515 UNITS
NURSERY DEVELOPMENT

COASTAL WATERSHED WORKS

INDICATOR		OUTCOMES/ IMPACT	
1	Wetland Inlet improvement works	1	181
2	Bund plantation in west land	2	2,778 plants
3	Agroforestry in coastal area	3	17 ha

17 ha
AGROFORESTRY

181
WETLAND INLET WORK

2,778
PLANTS (BUND PLANTATION)

6.2 OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

OUTCOMES OF DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

INDICATOR		OUTCOMES/ IMPACT	
1	Assessment of sources of water for live-stock and agriculture demand No of structures established for on-farm (in-situ) water harvesting in dry lands	1	363 farm ponds established which target the harvest of 6,38,880 cu. m of water which has the potential to irrigate 127.3 ha area
2	Improvement in soil health	2	191 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	3	724 ha under dry land horticulture
4	Households established fodder plots	4	191 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	5	2,350

363
FARM PONDS

191
COMPOST UNITS

191
FODDER PLOTS

724 ha
DRY LAND HORTICULTURE

2,350
SHEDS FOR LIVESTOCK'S

6.3 OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

	INDICATOR	OUTCOMES/ IMPACT
1	No. of villages having liquid waste management systems	2,061 individual and 209 community level soak pits established for recycle of grey water benefiting 22,157 HHs
2	Roof rain water harvesting measures	50 common roof rainwater harvesting and storage structures with a target to harvest and store 0.2 ha.m of rainwater for use
3	Nutri-garden	22,157 HHs established nutri-gardens in homesteads and planted 1,10,785 saplings

209 COMMON & **2,061** INDIVIDUAL SOAK PITS

50 COMMON ROOF RAINWATER HARVESTING

22,157 NUTRI-GARDENS

1,10,785 SAPLINGS

6.4 OUTCOMES OF CLIMATE RESILIENCE MEASURES

OUTCOMES OF CLIMATE RESILIENCE MEASURES

	INDICATOR	OUTCOMES/ IMPACT
1	Climate resilient measures are identified for climate risks	7 models are identified via., Farm ponds, horticulture park, avenue plantation, mini forest, mega forest, and tankas 153 farm ponds Horticulture Park in 0.50 ha. Mega forest in 4.5 ha area with 45,000 plants Avenue plantation along the road of length 8.22 km with 2,474 plants Mini forest in 2.75 ha with 27,5000 plants Tankas in 23 GPs 25 Nursery development sites

153 FARM PONDS

8.22 km AVENUE PLANTATION

2.75 ha MINI FOREST

25 NURSERY

0.5 ha HORTICULTURE PARK

4.5 ha MEGA FOREST

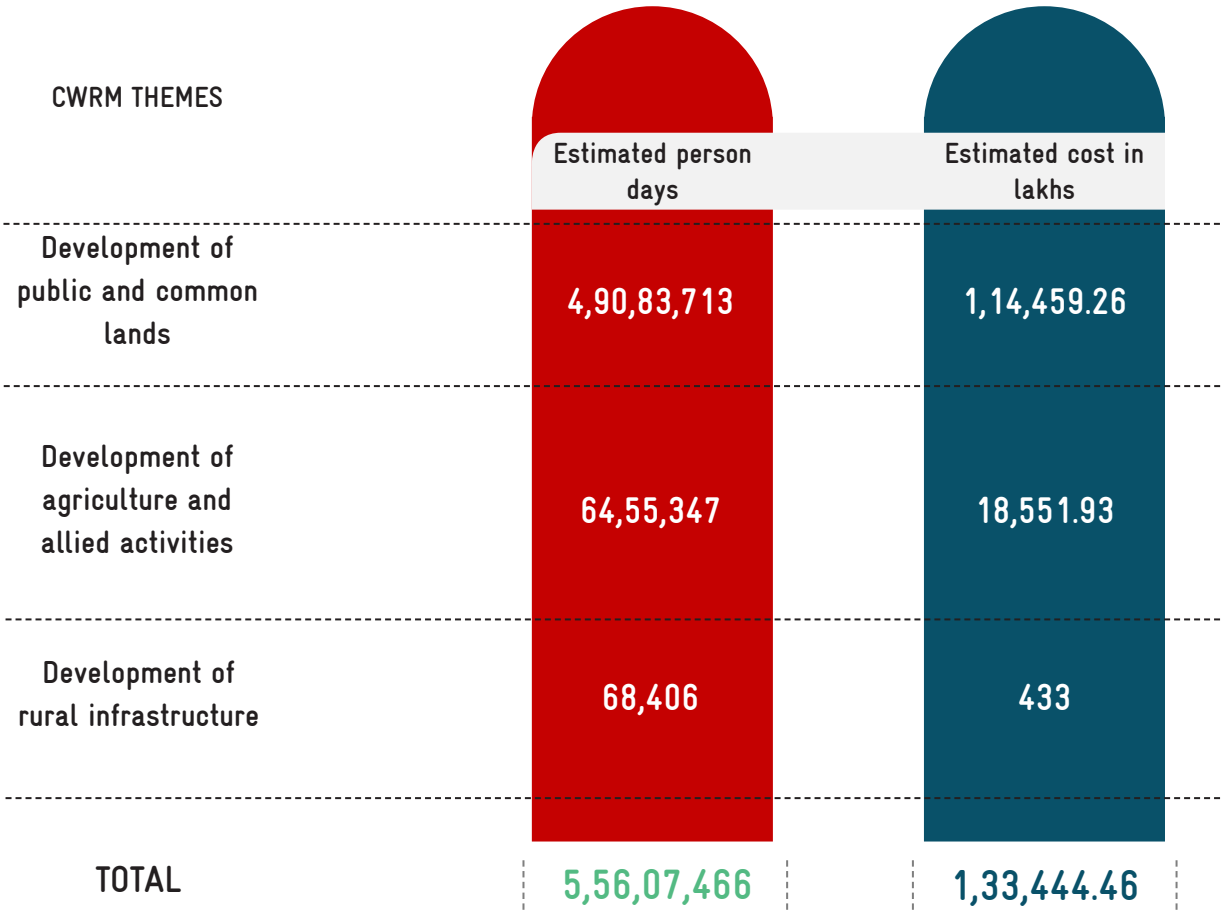
23 TANKAS

Estimated person days

The total estimated person days required for the above propose activities are 5,56,07,466 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above propose activities is Rs. 1,33,444.46 Lakhs as specified below in Figure 6.2.



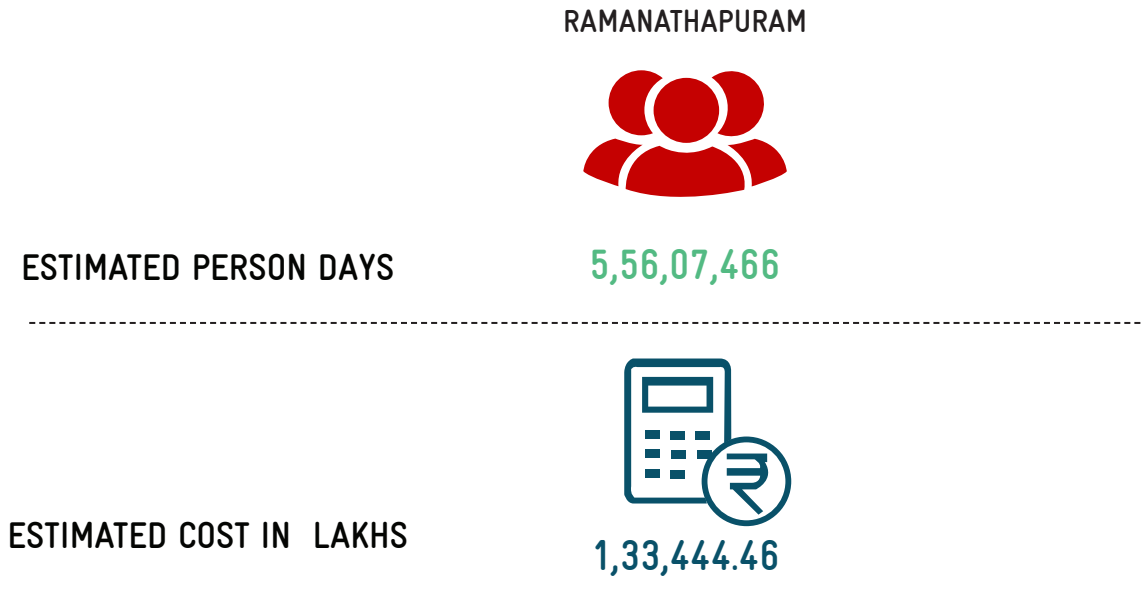


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

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 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.

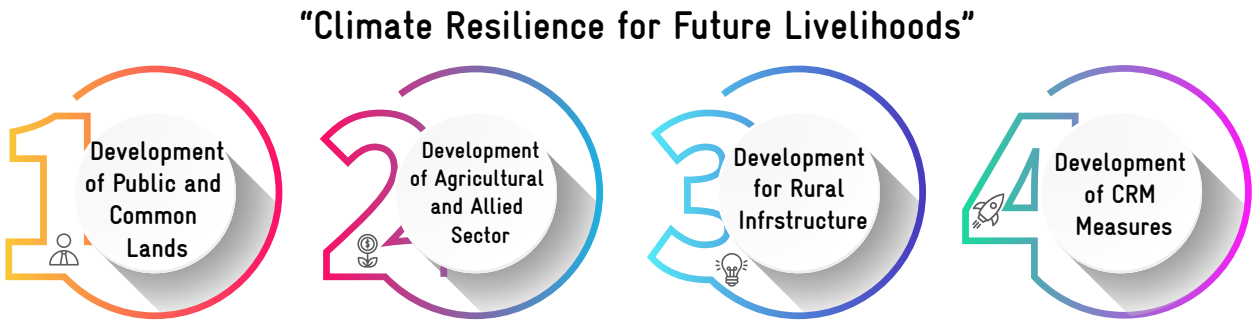
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national 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.

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 22).

TABLE 22. 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 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 23 to 25.

TABLE 23. WATER ACTIONS ON DEVELOPMENT OF PUBLIC & COMMON LANDS & ITS LINKED SDG

Name of the work	No. of CWRM works	Climate Vulnerability Index Impacting (WASCA TN)	Linked SDG Goal
Contour Continuous Bunds for Afforestation area (m)	6,971	W3	SDG 1,2, 6,13&15
Composting (No. of units)	371	W1	SDG1& 6
Afforestation in Public/common lands (ha)	1,743	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	7,513	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	0	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	41	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	404	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	15,004	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	81	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	515	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies :PWD and Union Tanks (No.)	57	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	239	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	4	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	378	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	15,004	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	2,010	W1,W3,W4	SDG1 & 6
Coastal watersheds works			
Nursery development -Coastal plantation (No.)	0	C1,S2,S4	SDG 1, 6, 13,
Mangrove plantations(ha)	0	C1,C2,C3,W3,S2	SDG 1, 6, 13, 14, 15
Riverside plantation(ha)	0	W3,S2	SDG 1, 6, 13, 14, 15
Coastline Shelter belt Plantation (ha)	0	W3,S2	SDG 1, 6, 13, 14, 15
Bund Plantation wet lands (km)	833	W3,S2	SDG 1, 6, 13, 14, 15
Wetland plantation (inner) (ha)	0	W3,S2	SDG 1, 6, 13, 14, 15
Coastal wetland - Bund strengthening (km)	4624	W3,S2	SDG 1, 6, 13, 14, 15
Wetland Inlet improvement works (No.)	181	W3,S2	SDG 1, 6, 13, 14, 15
Check dam for controlling sea water intrusion (No.)	0	W5	SDG 1, 6, 13, 14, 15
Construction of Fish Drying Yard (No.)	0	S2	SDG 1, 2, 4, 12
Agro Forestry in Individual lands (ha)	66	S2	SDG 1, 2, 6, 13

TABLE 24. WATER ACTIONS ON DEVELOPMENT OF AGRICULTURAL AND ALLIED SECTOR & ITS LINKED SDG

Name of the Work	No. of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	1,449	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	216	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	363	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	455	W1,W5,A1,A3,S2,S4	SDG 2, 6&
Dry land Horticulture/Agro-forestry - Individual (ha)	724	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	191	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	191	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	191	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	191	S4	SDG 1& 2

Goat/sheep shelters (No. of units)	1,733	S4	SDG 1& 2
Cattle trough (No. of units)	191	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	426	S2,S4	SDG 1& 2

TABLE 25. 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)	209	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	2061	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	50	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

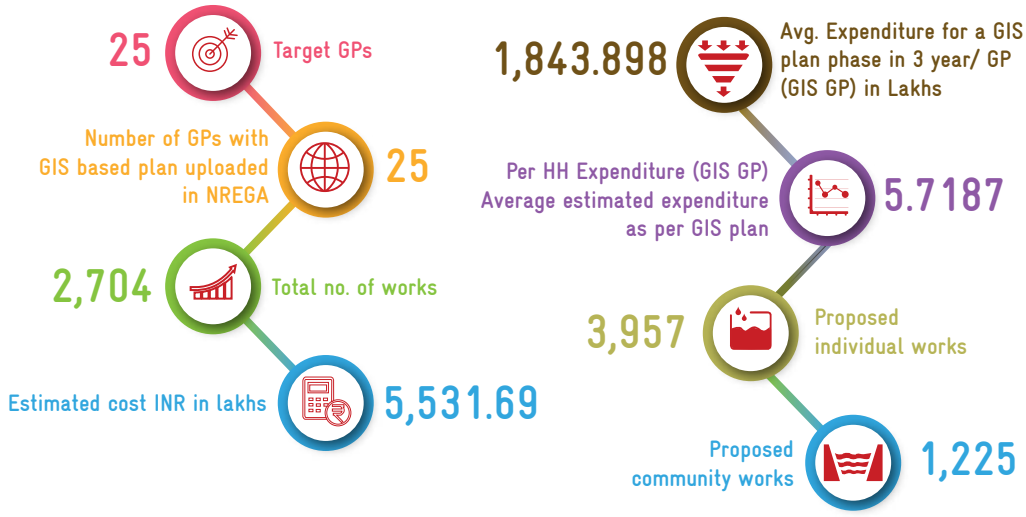
7 IMPLEMENTATION OF GP PLANS

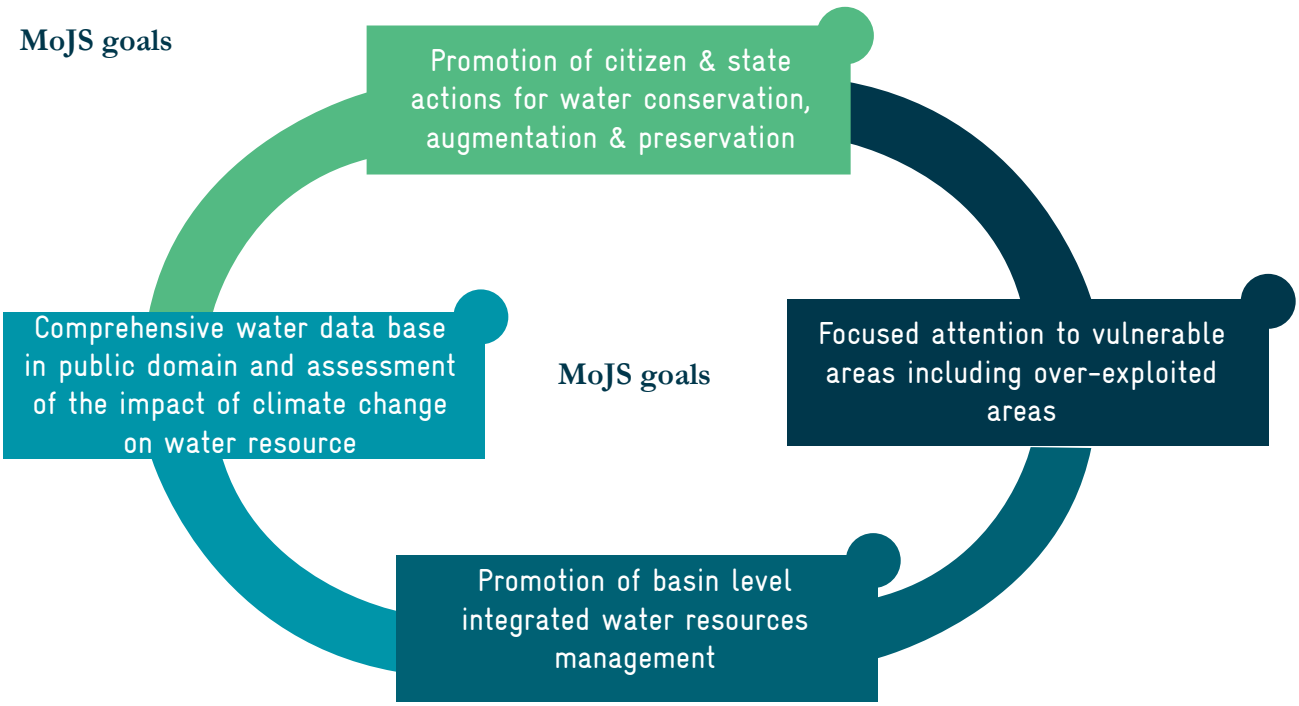
Execution of GP plans includes integrating all verified, approved works in MORD's web enabled ap¬plication NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identi¬fied first, the status of GIS based plans and total works along with its expenditure and category wise esti¬mation 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 Ramanathapuram Block is listed in Table 26 and work progress, 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 26. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN RAMANATHAPURAM BLOCK





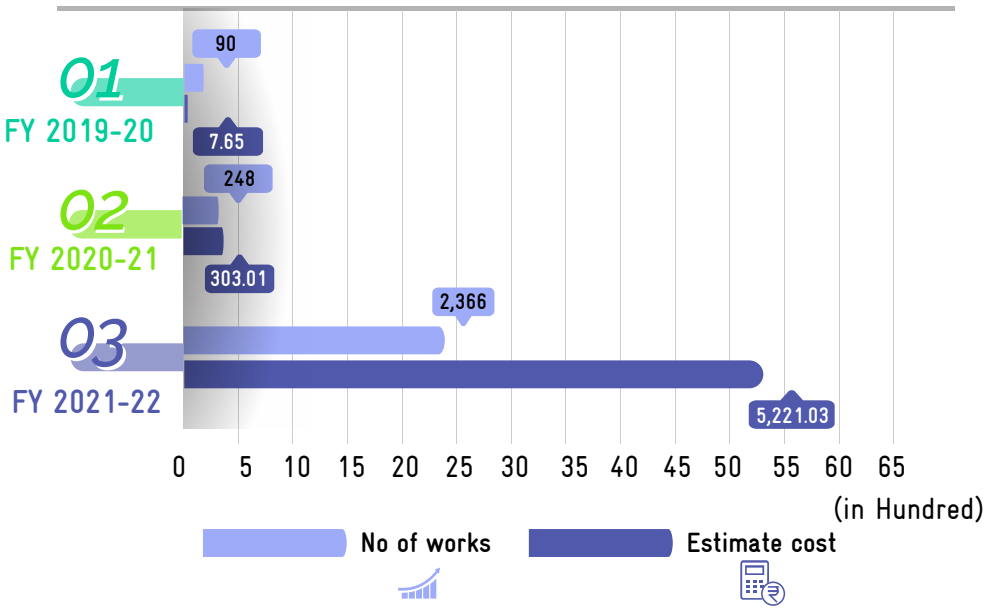


Figure 7.1. Work progress in last three years

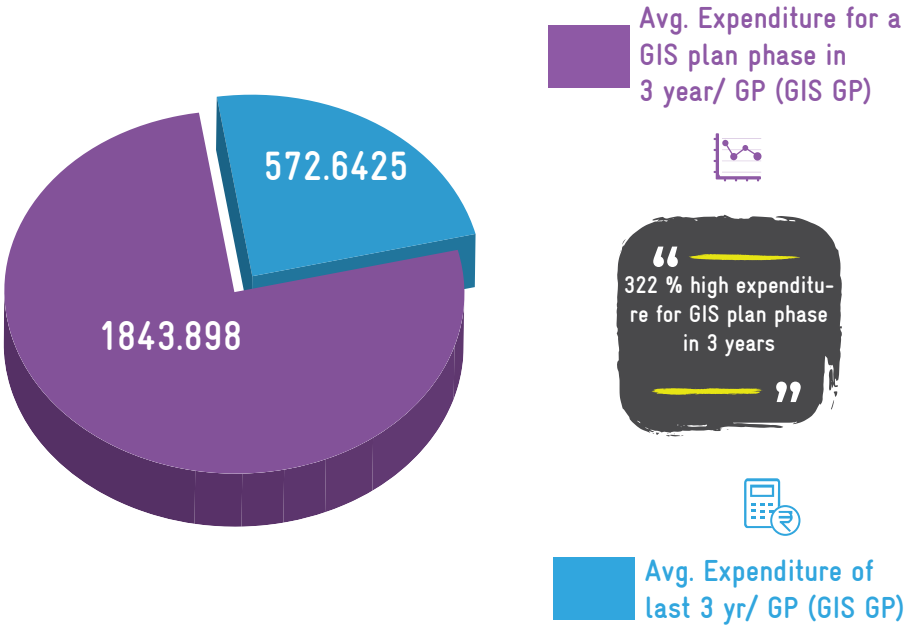
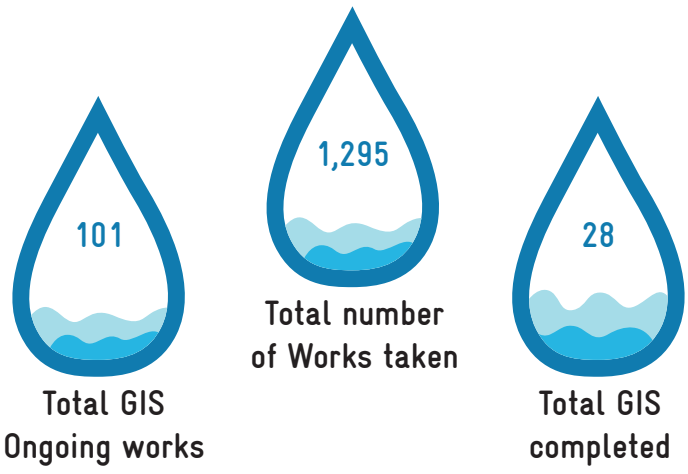


Figure 7.2. Average Expenditure for GIS plan in last 3 years



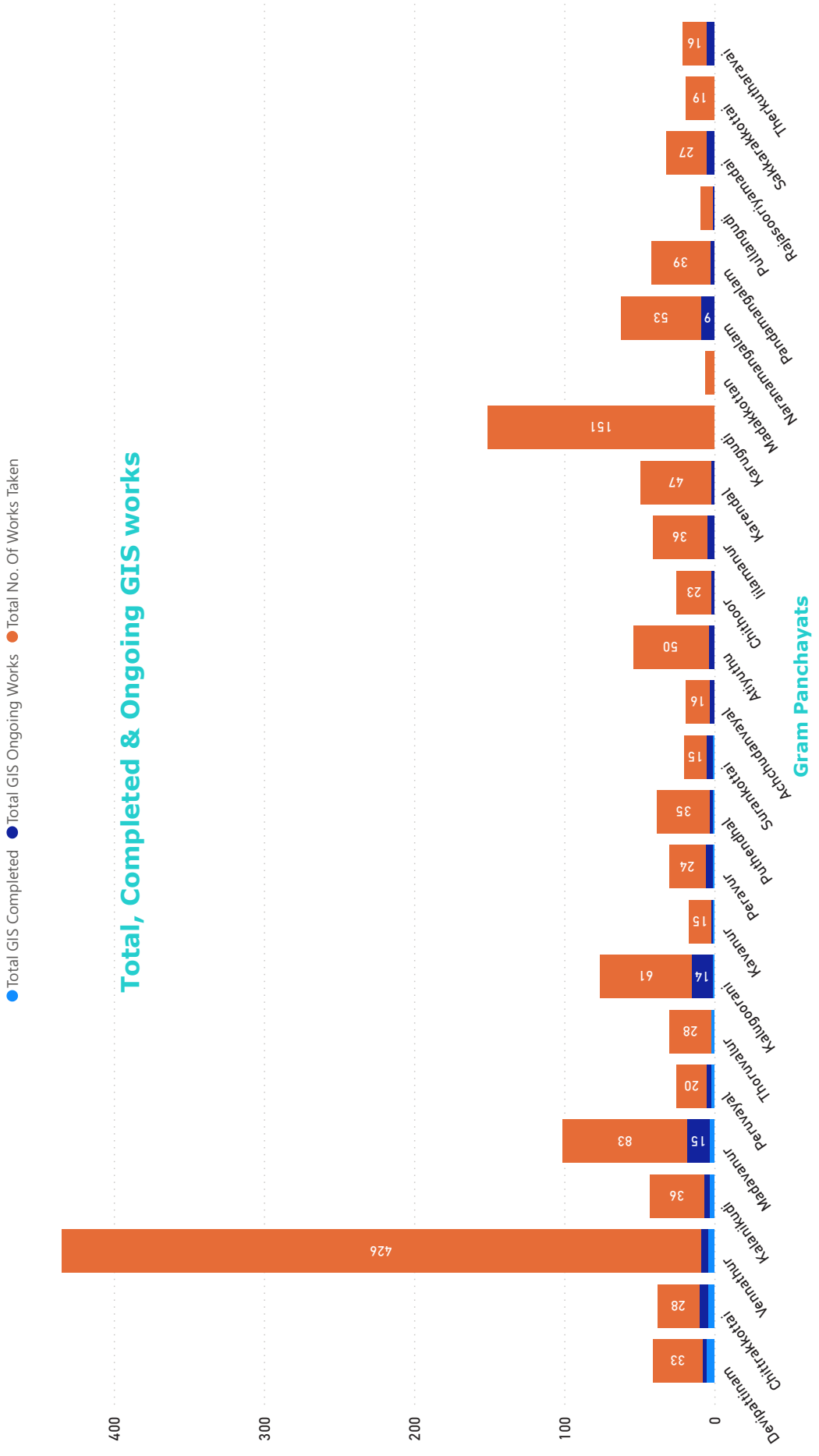
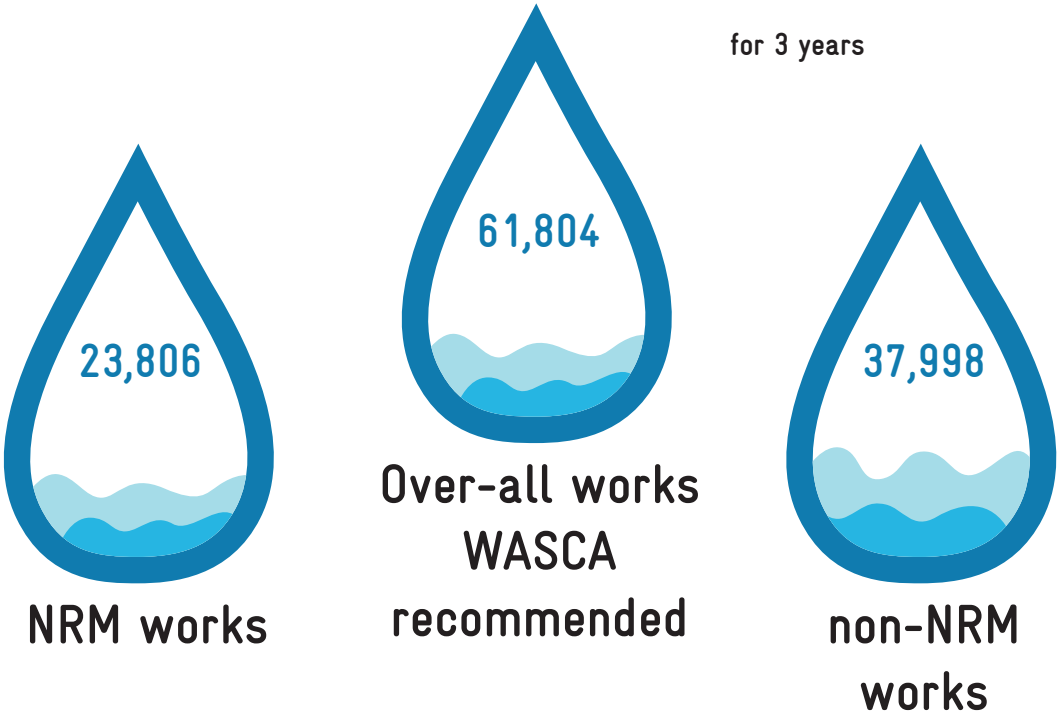


Figure 7.3. GP wise total, completed and ongoing GIS works

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 61,804 works for a period of 3 years, out of which 23,806 are NRM works and 37,998 are non NRM works (Figure 7.4). A total of 2,327 works has been uploaded so far for the financial year 2021-22 as on 21/02/2022.



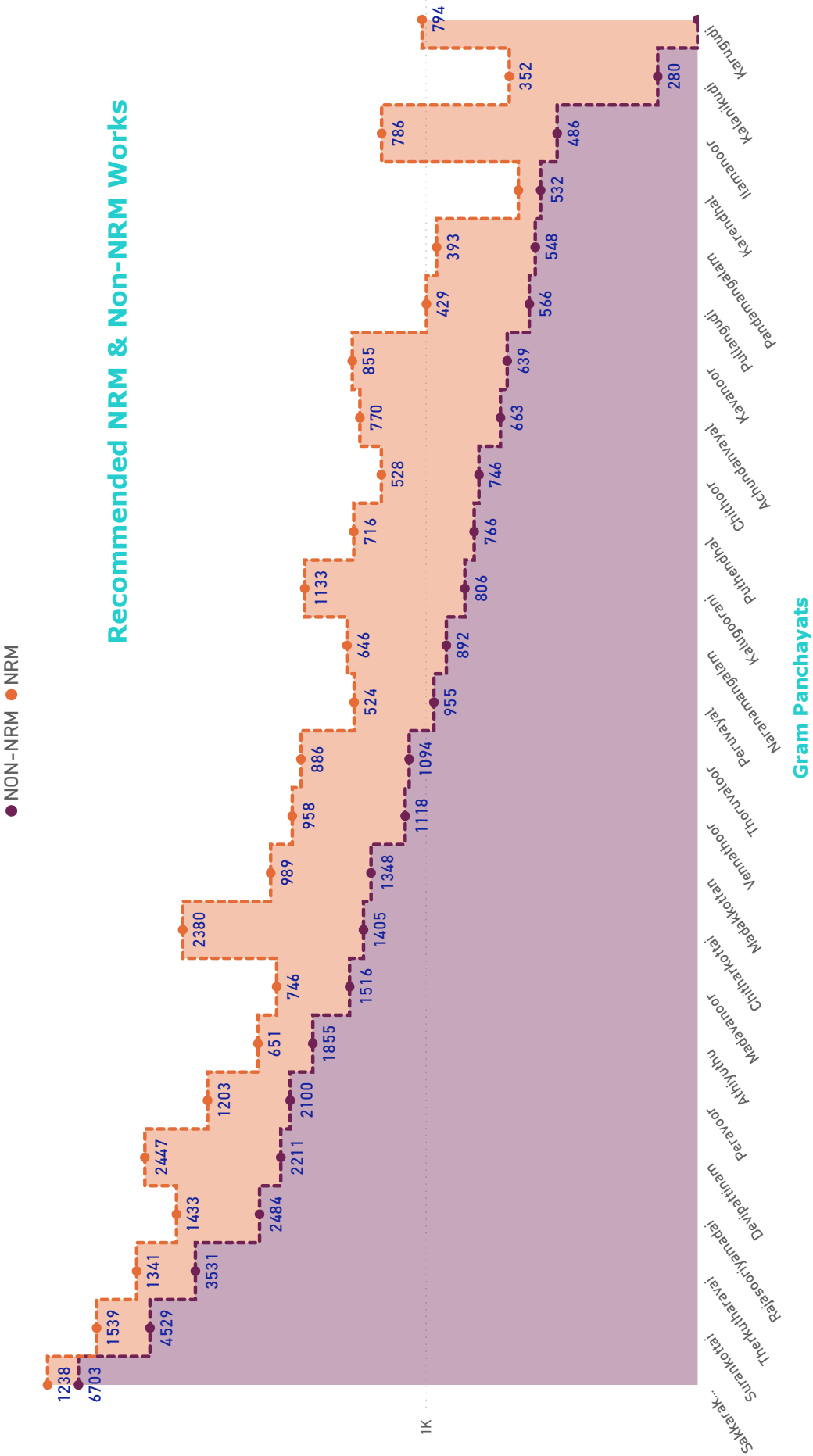


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in Ramanathapuram Block includes Water Conservation and Water Harvesting, Works on Individuals Land (Category IV), Rural Connectivity, and Drought Proofing. A total of 66 works is ongoing in the Block, in which WCWH related work are more (56 %) followed by individual beneficiaries works (30 %) while rural infrastructure works are less in numbers (Figure 7.5), GP and work category wise ongoing works are tabulated in Annexure 7.2.

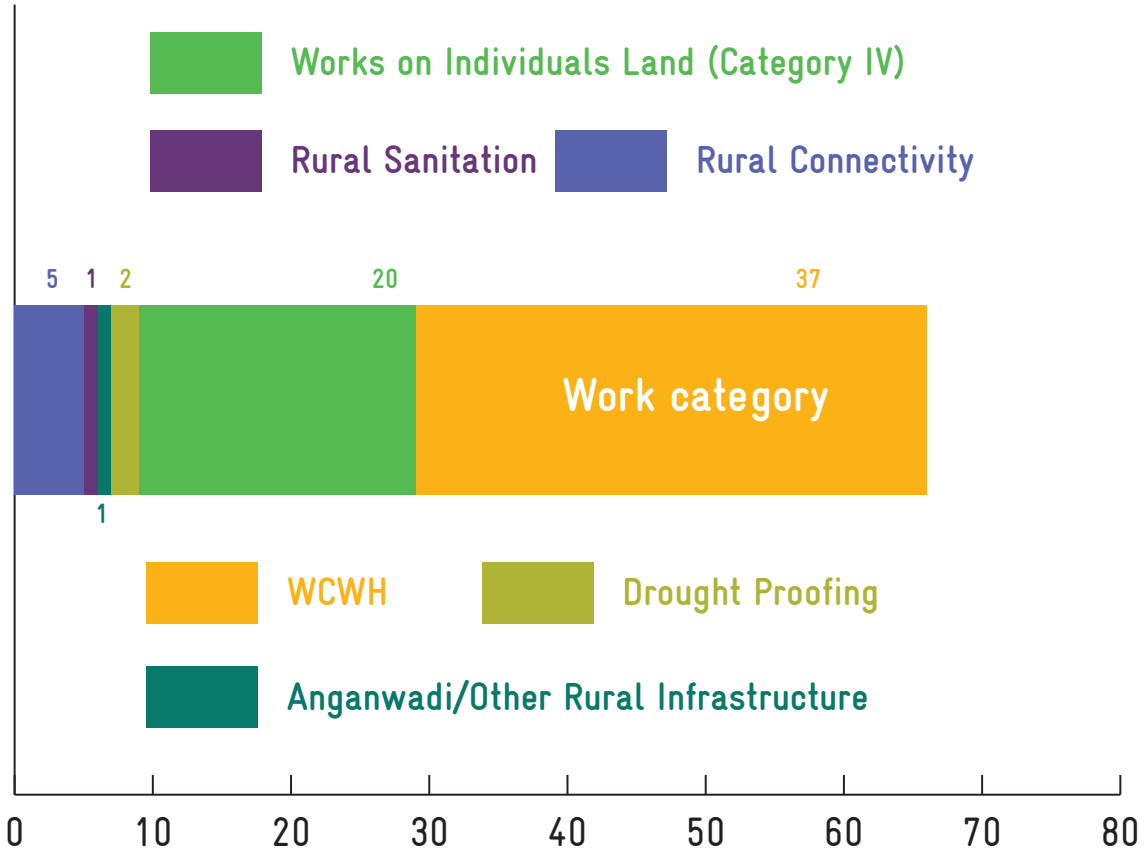


Figure 7.5. Category-wise ongoing works in Ramanathapuram Block

7.4 CATCH THE RAIN

The NWM's campaign "Catch The Rain" with the tagline "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 subsoil 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 Ramanathapuram Block is Rs. 1,199.68 Lakhs and nearly 74 % of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

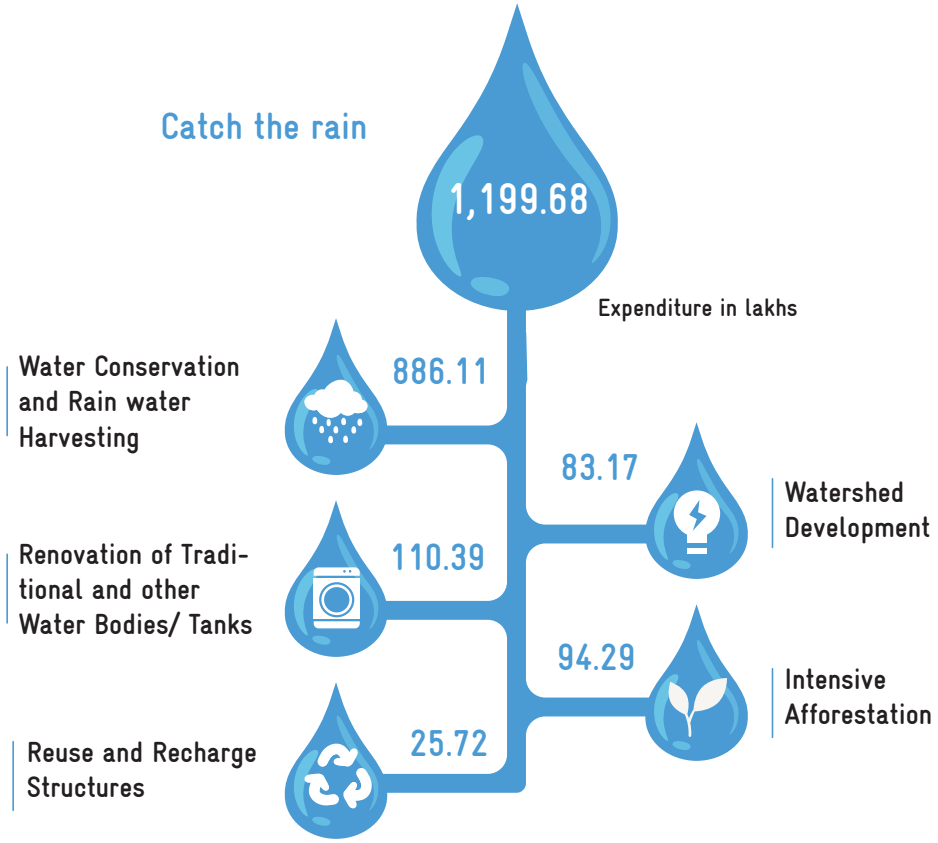
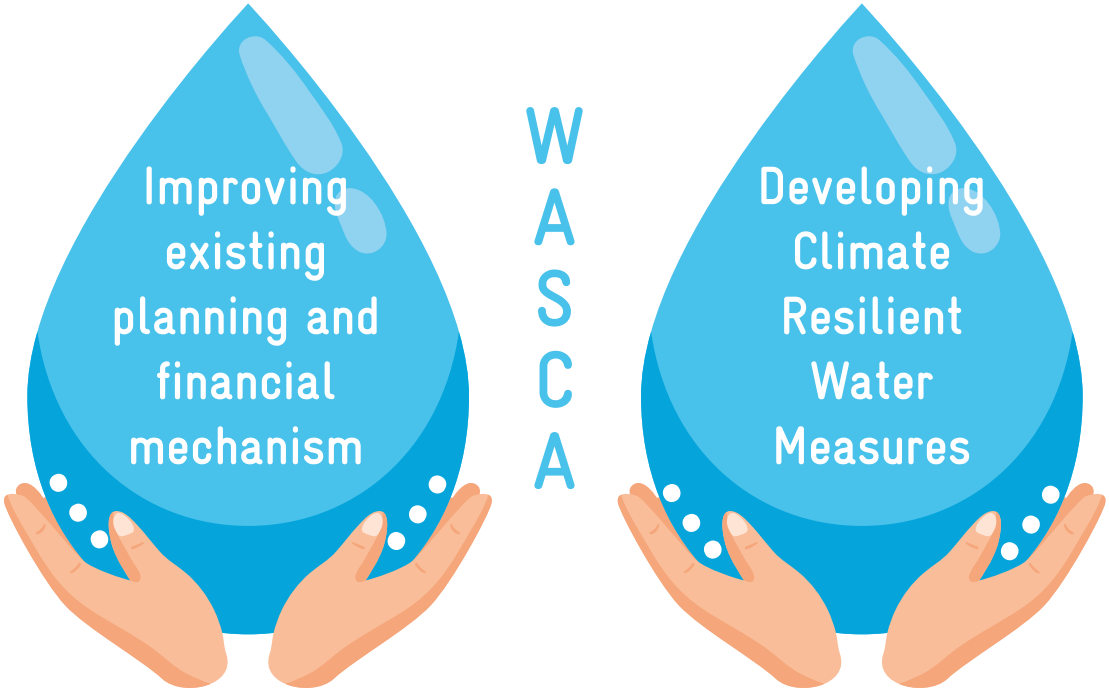


Figure 7.6. Expenditure for Catch the Rain campaign in Ramanathapuram Block



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 RAMANATHAPURAM BLOCK

Ramanathapuram Block comes under Lower Vaigai and Kottakkaraiyar sub-basin of Vaigai and Pambar Kottakkaraiyar basin. Vaigai river flows through the Block. Lower Vaigai (4) (4A2A1) macro-watershed covers the Block with 64 micro-watersheds covering an area of 27597.60 ha (Figure 8.1) and (Table 27). In Ramanathapuram Block all 25 GPs, fall under Lower Vaigai (4) watershed. (Table 28). The micro-watershed related works are identified using Basin, Sub-basin, and micro-watershed with GP administrative boundaries through CWRM approach.

TABLE 27. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING RAMANATHAPURAM BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Lower Vaigai (4)	27597.60	64

TABLE 28. NO. OF GPs COVERED UNDER WATERSHEDS IN RAMANATHAPURAM BLOCK

Name of watershed	No. of GPs
Lower Vaigai (4)	25

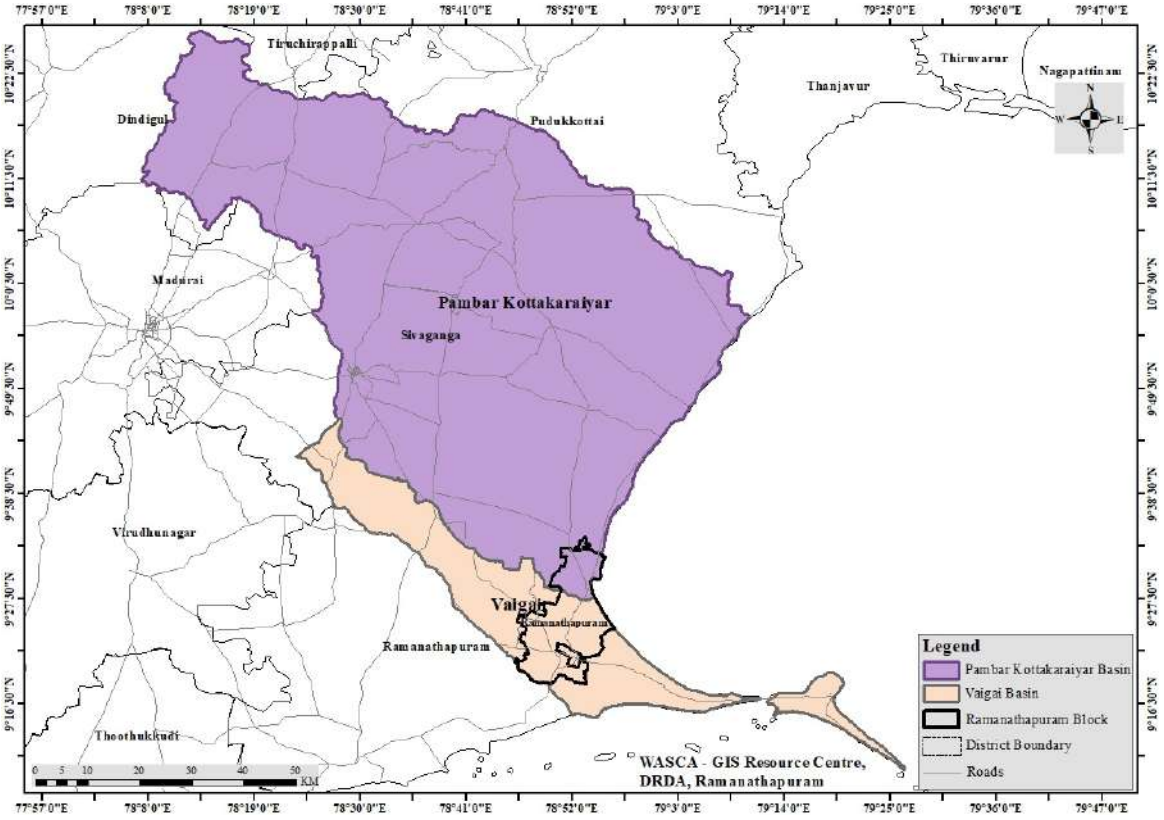


Figure 8.1. Macro-watershed map of Ramanathapuram Block

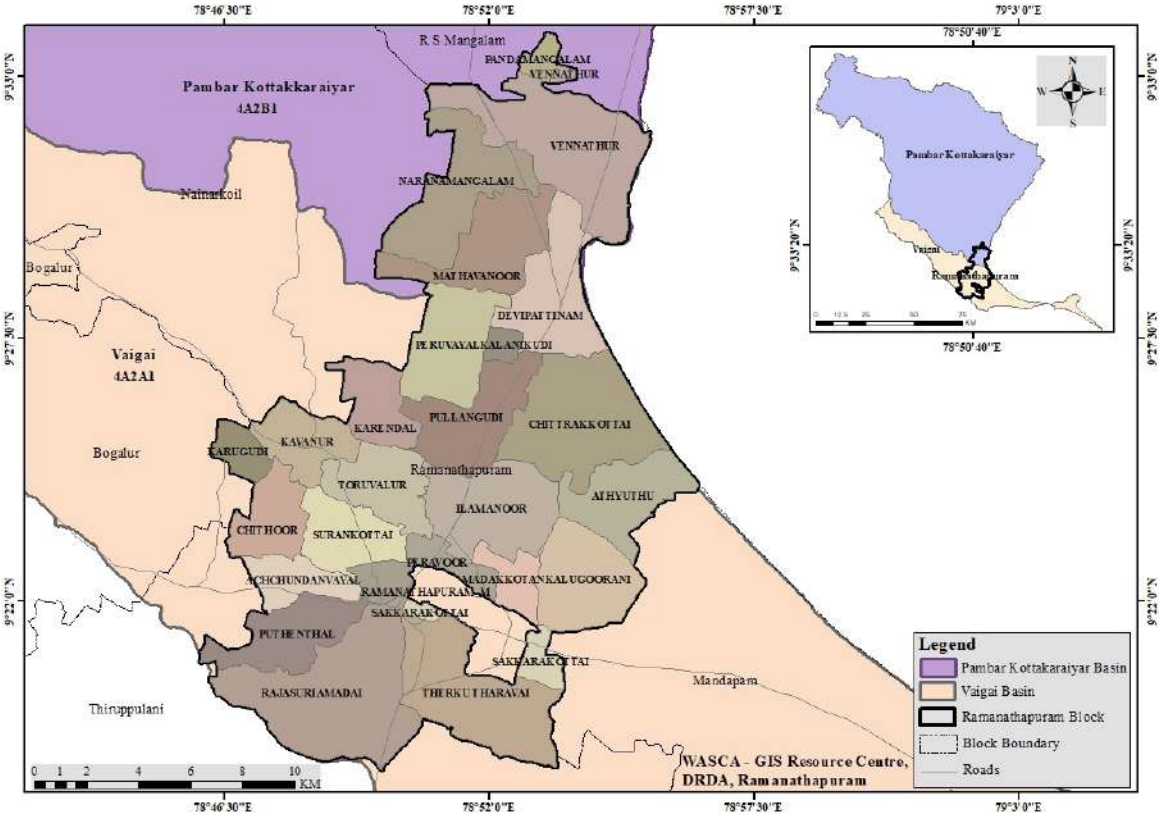


Figure 8.2. Macro-watershed with GPs

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, proposed works in all macro-watersheds of GPs in Ramanathapuram Block are listed in Tables 29 to 31.

TABLE 29. MICRO-WATERSHED IN RAMANATHAPURAM BLOCK FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2B1a06b	0.140758711	Lower
2	4A2A1e02a	117.3223347	
3	4A2A1e02b	221.4578742	
4	4A2A1e02c	53.00512419	
5	4A2A1e03a	153.0102442	
6	4A2A1e03b	494.6124503	
7	4A2A1e01c	603.4875802	
8	4A2A1e01e	400.8710607	
9	4A2A1e03c	242.8774297	
10	4A2A1e01b	297.0491419	
11	4A2A1e01d	433.1860291	
12	4A2A1e06b	138.0665887	
13	4A2A1e01a	1174.228686	
14	4A2A1e04d	569.8012744	
15	4A2A1e06a	400.7705443	
16	4A2A1e04b	619.8316273	
17	4A2A1e06c	207.842216	
18	4A2A1e04a	775.8804627	
19	4A2A1e04c	392.1621434	
20	4A2A1a13b	66.8521951	
21	4A2A1a12b	782.3649735	
22	4A2A1a13a	293.002091	
23	4A2A1a12d	263.8587409	
24	4A2A1a12c	449.9816628	
25	4A2A1a04b	606.5432342	
26	4A2A1a01b	59.4767848	
27	4A2A1a04a	850.07781	
28	4A2A1a12a	444.4096621	
29	4A2A1d02a	183.4951641	
30	4A2A1a03c	1046.20301	
31	4A2A1a02c	852.8869689	
32	4A2A1d01a	325.8697531	
33	4A2A1d06a	32.00119618	
34	4A2A1c01b	923.8941024	
35	4A2A1c01c	532.4993103	
36	4A2A1a01c	777.5705538	
37	4A2A1a03b	326.7009583	
38	4A2A1a02b	493.0324534	

39	4A2A1a03a	304.0769539	Lower
40	4A2A1d01c	1350.603739	
41	4A2A1d01b	158.9787769	
42	4A2A1c02c	818.9108066	
43	4A2A1c01a	323.459026	
44	4A2A1c01d	448.0152497	
45	4A2A1c02b	271.0817623	
46	4A2A1b04b	323.2047865	
47	4A2A1c02a	407.9337208	
48	4A2A1b04a	621.59674	
49	4A2A1b04c	512.3703111	
50	4A2A1c05b	114.3932418	
51	4A2A1b03a	152.5930981	
52	4A2A1c05a	1889.611847	
53	4A2A1c07d	10.26213765	
54	4A2A1b06c	1011.39461	
55	4A2A1b03b	42.57639167	
56	4A2A1c07c	30.38046861	
57	4A2A1c07b	262.1516489	
58	4A2A1b03c	47.13960196	
59	4A2A1c06c	867.7264249	
60	4A2A1b05e	352.7264329	
61	4A2A1c06b	349.586041	
62	4A2A1b06b	208.3489624	
63	4A2A1b08a	91.3574004	
64	4A2A1c06a	20.78591094	

TABLE 30. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN RAMANATHA-PURAM BLOCK

Sl.No	Name of the GP	Ridge Type
1	Achundanvayal	Lower
2	Athiyuthu	
3	Chitharkottai	
4	Chithoor	
5	Devipattinam	
6	Ilamanoor	
7	Kalanikudi	
8	Kalugoorani	
9	Karendhal	
10	Karugudi	
11	Kavanoor	
12	Madakkottan	
13	Madavanoor	
14	Naranamangalam	
15	Pandamangalam	
16	Peravoor	

17	Peruvayal	Lower
18	Pullangudi	
19	Puthendhal	
20	Rajasooriyamadai	
21	Sakkarakkottai	
22	Surankottai	
23	Therkutharavai	
24	Thoruvaloor	
25	Vennathoor	

TABLE 31. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN RAMANATHAPURAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	17427.9
2	Afforestation in Public/common lands (ha)		1742.79
3	Drainage Line Treatment (m)		80409
4	Block Plantation (Community) (ha)		7513.33
5	Avenue plantation (km)		81.26
6	Composting (No.)		371
7	Canal Bund Plantation (km)		26.31
8	Restoration of water bodies: Tanks and Ooranis (No.)		292
9	Artificial Recharge Structure (No.)		667
10	Farm Bunding with Boundary Trenches - Individual (ha)		1449.07
11	Construction of Farm Ponds - Individual (No.)		363
12	Land development - Individual (ha)		455.33
13	Azolla units - Individual (No.)		191
14	NADEP Vermi compost (No.)		1156
15	Fodder development - Community & Individual (No.)		191
16	Cattle Shelters (No.)		191
17	Goat Sheep Shelters (No.)		1733
18	Cattle Trough (No.)		191
19	Soak Pits (Community) (No.)		209
20	Soak Pits (Individual) (No.)		2061
21	Roof Rain Water Harvesting (No.)		50
22	Agro Forestry (ha)		66.36
23	Nutri Garden (No.)		25
24	Silt application (No.)		182
25	Mini Forest (No.)		55
26	Bird Watching Tower (No.)		3
27	Wetland Bund Strengthening (km)		37.9
28	Wetland Bund Plantation (No.)		9476
29	Wetland Inlet (No.)		5

8.2 MODEL MICRO-WATERSHED- THERKKU PERUVAYAL

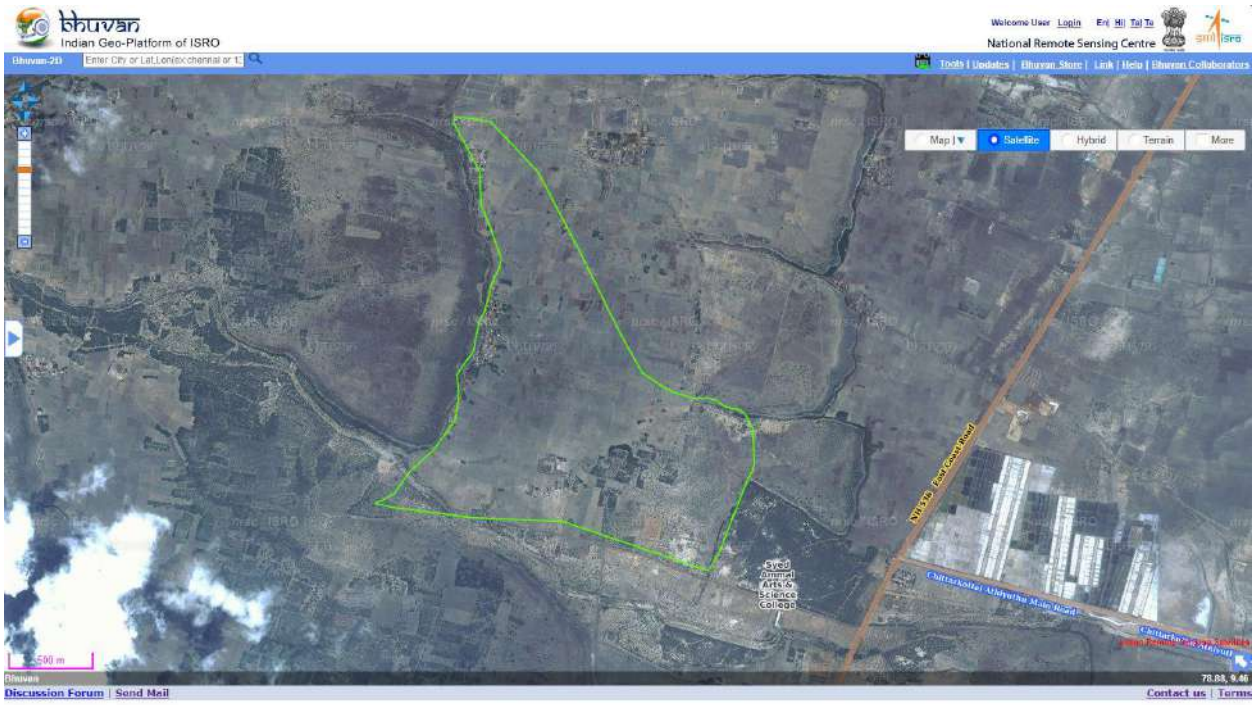


Figure 8.3. Therkku Peruvayal micro-watershed over satellite image

The micro-watershed case study addresses the issues of water conservation and climate change through an 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.

THERKKU PERUVAYAL MICRO-WATERSHED

Therku Peruvayal micro-watershed falls under Peruvayal Gram Panchayat, Ramanathapuram Block in Ramanathapuram District. Micro-watershed over satellite image is shown in Figure 8.3. This micro-watershed is part of Lower Vaigai (4) macro-watershed in Lower Vaigai sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of Therku Peruvayal 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 32 to 43 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is Annexed 8.

TABLE 32. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Theruku Peruvayal Micro-watershed
Micro-watershed Number	4A2A1a12d
Name of the Basin	Vaigai Basin
Name of the sub basin	Lower Vaigai Sub Basin
Name of the Macro-watershed	Lower Vaigai (4)
Number of GPs covered under the Micro-watershed	1
Name of the GP	Peruvayal
Latitude of Micro-watershed (From To)	9°18'7.91"N to 9°19'51.601"N
Longitude of Micro-watershed (From To)	79°0'31.474"E to 79°1'59.751"E
Total area of the Micro-watershed in ha	263.868
Percentage of Micro-watershed area in Peruvayal GP	100
Area of Micro-watershed falling in Peruvayal GP (ha)	263.868
Total Population of Peruvayal GP	1,410
Annual Average Rainfall (mm)	821
Annual maximum Temperature (°C)	32.6
Annual Minimum Temperature (°C)	23.8
Evapo -Transpiration Losses of Peruvayal GP (ha.m)	31.12
Volumetric soil moisture availability (%)	17
Climate Risk	Drought and heat waves
CVI Index Value for Peruvayal (Based on WASCA Climate study)	0.500 (High Water Vulnerability)
Agro-Climatic Zone	Southern Zone (TN 05)
Agro Ecological Sub-Region (ICAR)	Hot dry semi-arid eco sub region (18.1)
Status of Ground water in Peruvayal GP	Safe
Evapo-Transpiration Losses of Enmanamkondan GP (ha.m)	7.63
Volumetric soil moisture availability (%)	17
Climate Risk	Drought and heat waves
CVI Index Value for Irumeni (Based on WASCA Climate study)	0.508 (High water Vulnerability)
CVI Index Value for Enmanamkondan (Based on WASCA Climate study)	0.527 (High water Vulnerability)
Agro-Climatic Zone	Southern Zone (TN 05)
Agro Ecological Sub-Region (ICAR)	Hot dry semi-arid eco sub region (18.1)
Status of Ground water in Irumeni GP	Safe

TABLE 33. HYDROGEOLOGY OTHER CHARACTERISTICS IN MICRO-WATERSHED

Type of Geomorphology	Coastal Origin - Older Deltaic Plain
Geomorphology occurrence in %	100
Principle Aquifer	Alluvium
Salt Affected Area passing through the Micro-watershed	Sodic - Moderate
Type of lineaments passing through the micro-watershed	Geomorphic Lineaments, Drainage Parallel
Barren & waste lands	Nil

TABLE 34. EXISTING WATER HARVESTING STRUCTURES IN PERUVAYAL GP

Sl.No.	Name of Structure	Peruvayal GP	
		Existing Structures	
		No.	Area in ha
1	Oorani	5	4.78
2	Tank	3	84.52
	Total	**8**	**89.3**

TABLE 35. CATCHMENT AREA OF MICRO-WATERSHED (STRANGE METHODOLOGY - CGWB)

Catchment Area in ha	Peruvayal GP
Good catchment area	82.40
Average catchment area	57.10
Bad catchment area	60.10

TABLE 36. GROUND WATER STATUS OF MICRO-WATERSHED

Name of the Firka (Assessment Unit) falling under micro-watershed	Ramanathapuram
Recharge from other sources during monsoon season (ha.m)	743
Recharge from other sources during non-monsoon season (ha.m)	179.52

TABLE 37. SALINITY AND SEA WATER INTRUSION IN THE MICRO-WATERSHED

Pre monsoon Water Quality Index	Medium and Poor Quality
Post monsoon Water Quality Index	Very Poor Quality
Pre monsoon Sea Water Mixing Index	<=1
Post monsoon Sea Water Mixing Index	<=1

TABLE 38. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED-PERUVAYAL GPs

Water Budget in ha.m	Peruvayal GP
Water for domestic	12.06
Water for agriculture	199.6
Water for livestock's	1.34
Village wise water required	213.0
Available run-off from rain water (derived from Strange method)	55.0
Harvested Runoff from Water Harvesting Activities	6.6
Potential Harvesting from proposed Interventions	4.8
Total Water harvested	11.4
Water demand and Supply Difference	-201.6
Water demand supply gap status	Deficient
Per capita Water Availability in cum	124.83
International Standard per capita water Availability (cum)	1,700
Water Availability Gap (cum)	-1,575.17
Water security status	Water Stress

TABLE 39. GP WISE PROPOSED MICRO-WATERSHED WORKS – PERUVAYAL GP

Proposed Work	Peruvayal GP
Proposed works in Upper Ridge	0
Proposed works in Middle Ridge	0
Proposed works in Lower Ridge	86
Total works	86

TABLE 40. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED- PERUVAYAL GP

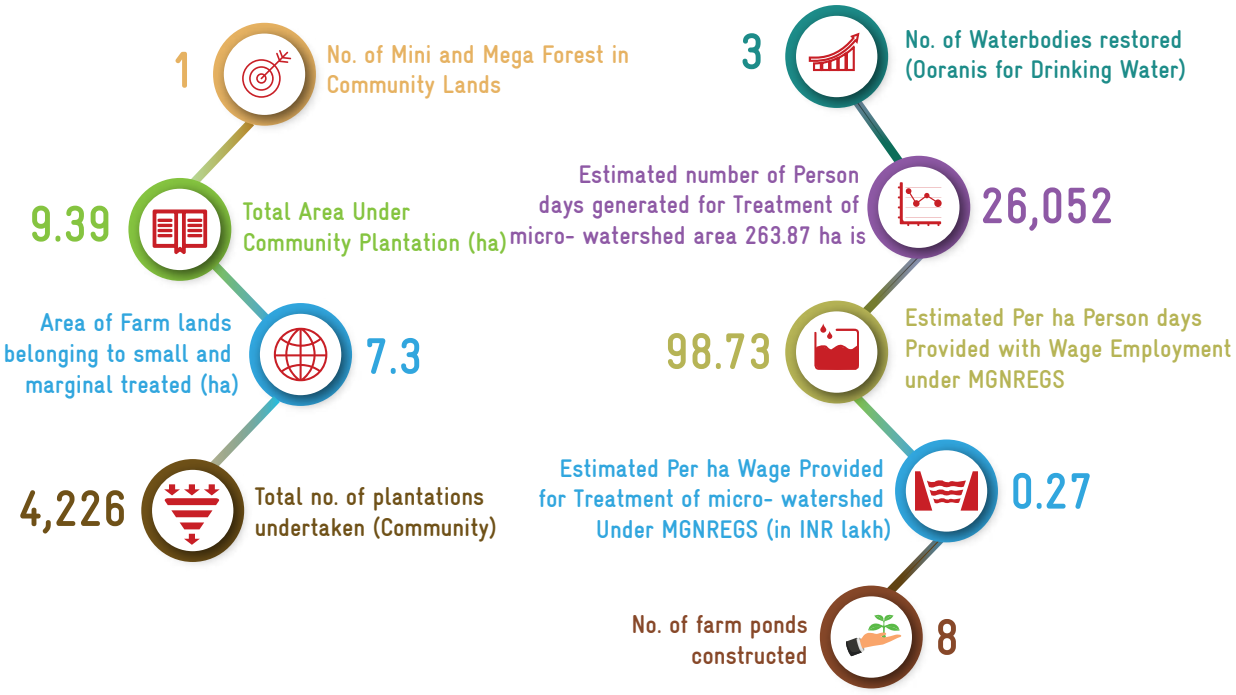
Ridge Type	Peruvayal GP
Lower Ridge	
Estimated cost for Lower Ridge area (INR in Lakhs)	97.88
Total area in ha of Lower ridge	263.868
Estimated Person days generated for Treatment of Lower Ridge	**26,052**
Treatment cost of Lower Ridge Lakhs/ha	**0.371**

Peruvayal GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.371 lakh/ha	26,052
	0.371 lakh/ha	26,052

TABLE 41. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	44
Total No. of works in Micro-watershed including livelihood Activities	21
Total No. of works in Micro-watershed including Rural Greywater Management Activities	21

TABLE 42. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Peruvayal GP	44.86 lakh

TABLE 43. ESTIMATES OF THERKKU PERUVAYAL MICRO-WATERSHED IN PERUVAYAL GP

Proposed Work	Ridge Type	Status of Work	Quantity (Area or No.)	No. of works as per KML	Estimate cost (INR in Lakhs)	Person days
NRM works in Public and Community Lands						
Restoration of Traditional water bodies: (Oorani & Tank) (No.)	Lower	Not commenced	3	3	21	7,642
Oorani bund Plantation (No.)			284	3	1.31	430
Avenue plantation (km.)			2.66	1	2.45	880
Block Plantation (ha)			3.61	1	7.47	2,721
Afforestation (ha)			5.78	1	11.97	4,366
Roof Rain Water Harvesting in GP Building (No.)			25,000 L	2	0.6	30
Sub total				**11**	**44.8**	**16,069**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	8	8	2.16	96
Farm Bunding with Boundary Trenches - Individual (ha &No.)			7.3		10.95	4102
			7	7		
Construction of Farm Ponds - Individual (No.)			8	8	14.4	4,960
Composting (No.)			7	7	0.63	217
Sub total				**30**	**28.14**	**9,375**
Total				**44**	**72.94**	**25,444**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Azolla Production Unit (No.)	Lower	Not commenced	4	4	0.6	56
Cattle Shelters (No.)			5	5	8	165
Poultry Shed (No.)			4	4	8	88
Goat Sheep Shelters (No.)			5	5	5.75	150
Cattle Trough (No.)			3	3	0.6	33
Sub total				**21**	**22.95**	**492**
Rural Greywater and Roof Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	12	12	1.3	72
Soak Pits (Community) (No.)			5	5	0.65	40
Nutri Garden (No.)			4	4	0.04	4
Sub total				**21**	**1.99**	**116**
Total				**86**	**97.88**	**26,052**

TOTAL ESTIMATES OF MICRO-WATERSHED IN IRUMENI GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Peruvayal GP	86	97.88	26,052

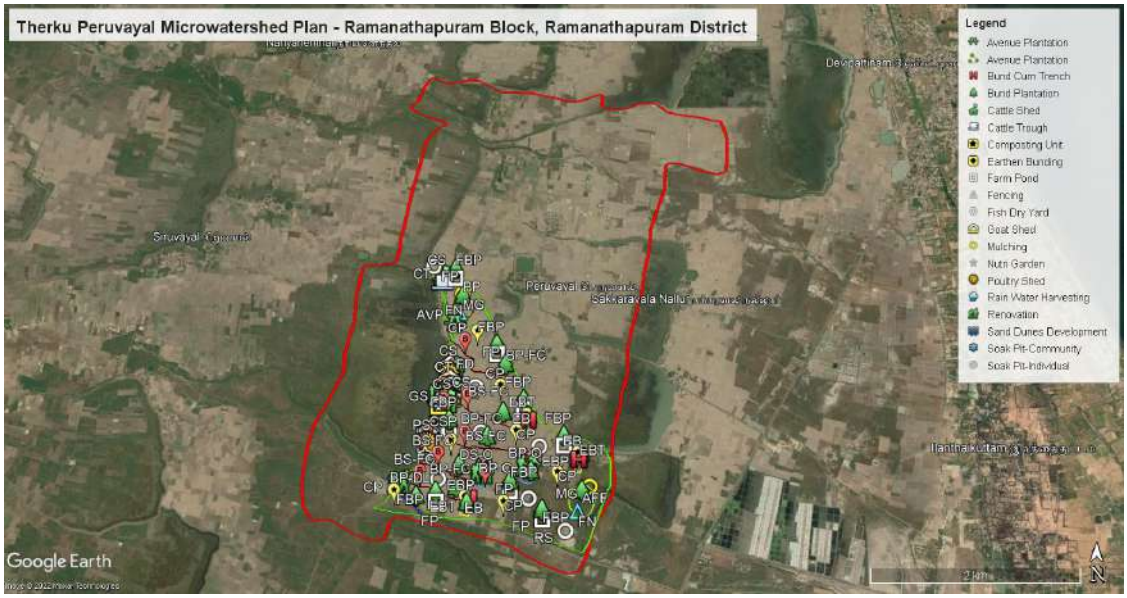


Figure 8.4. Proposed activities in Therkku Peruvayal micro-watershed

8.3 MODEL GP – PUTHENDAL

BACKGROUND OF GRAM PANCHAYAT - PUTHENDAL

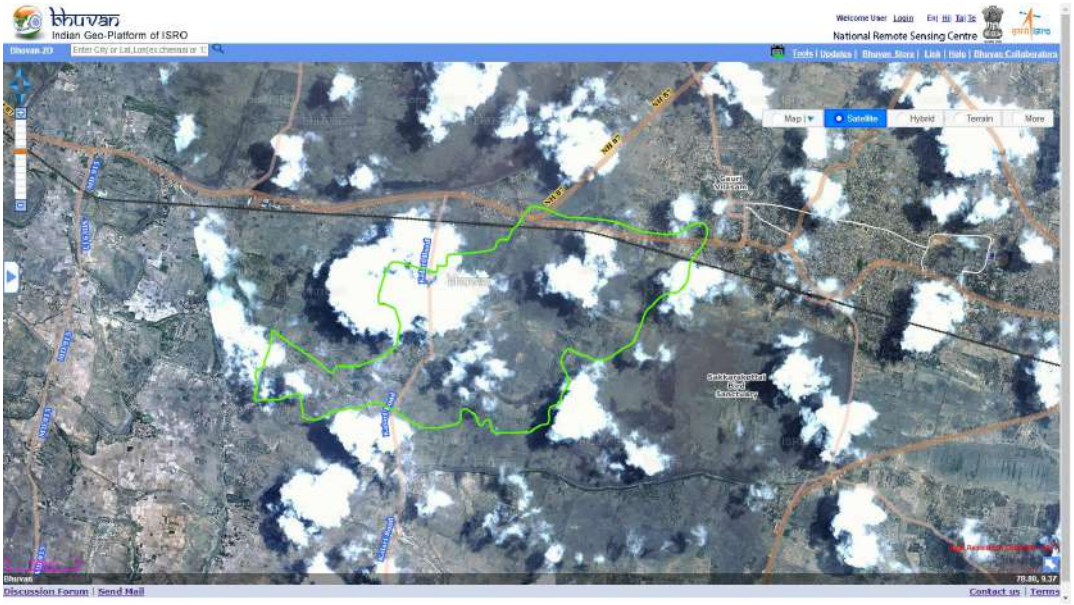
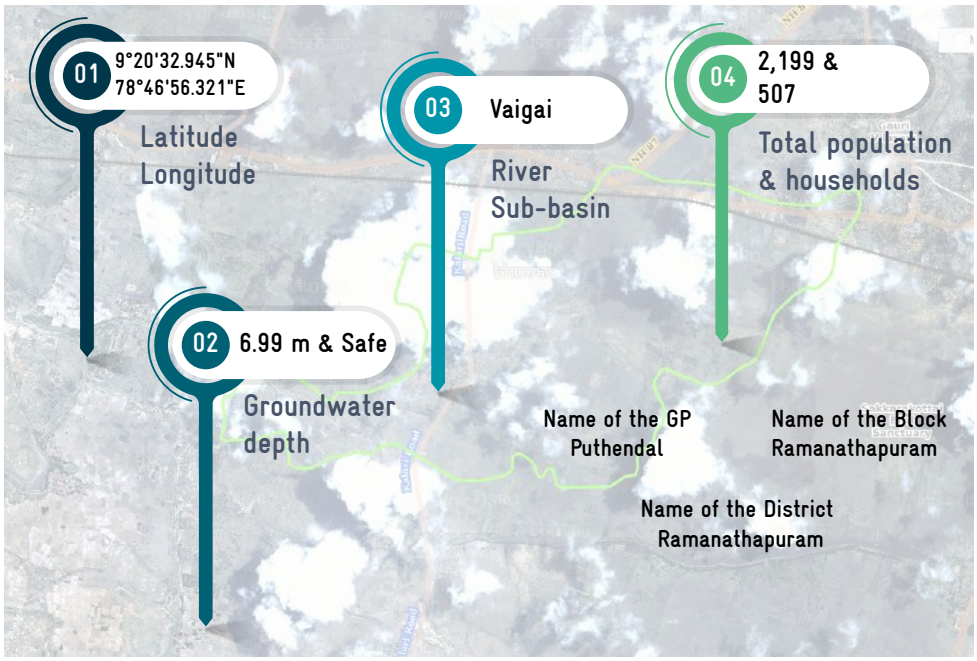


Figure 8.5. Puthendal GP over satellite image

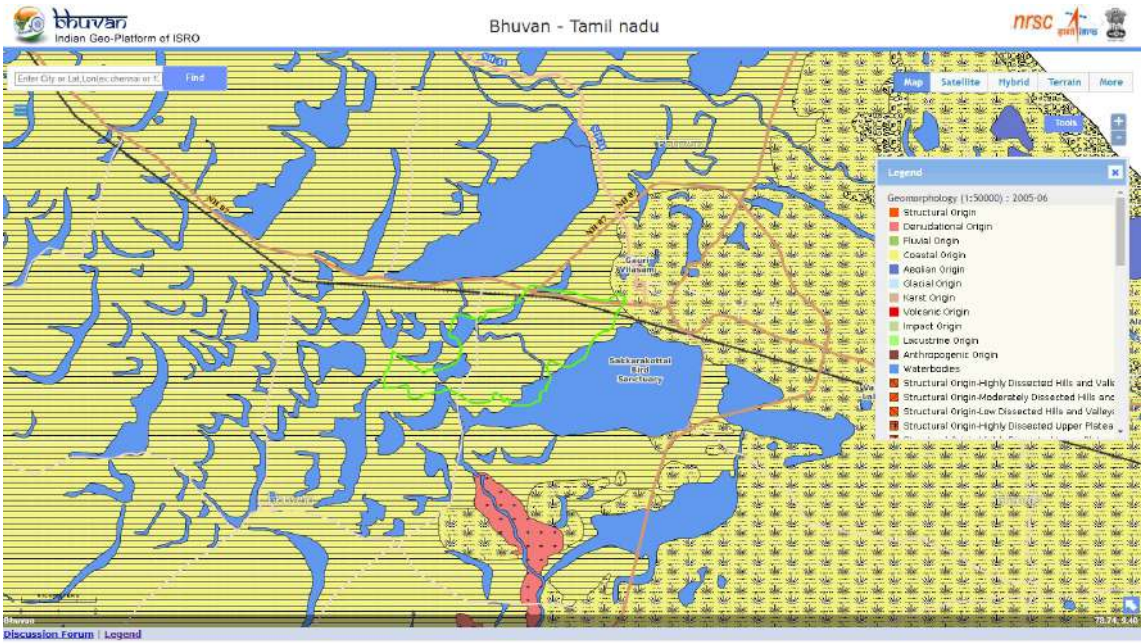
Puthendal GP is located in Ramanathapuram Block of Ramanathapuram District, Tamil Nadu. The total geographic area of this village is about 1,144 ha. As per the Population Census 2011, the total population of the GP is 2,199 out of which 1,094 are males, 1,105 are females. The total number of HH in the village is 507. 37% of the population comprises of SC population and no ST population (Table 44).

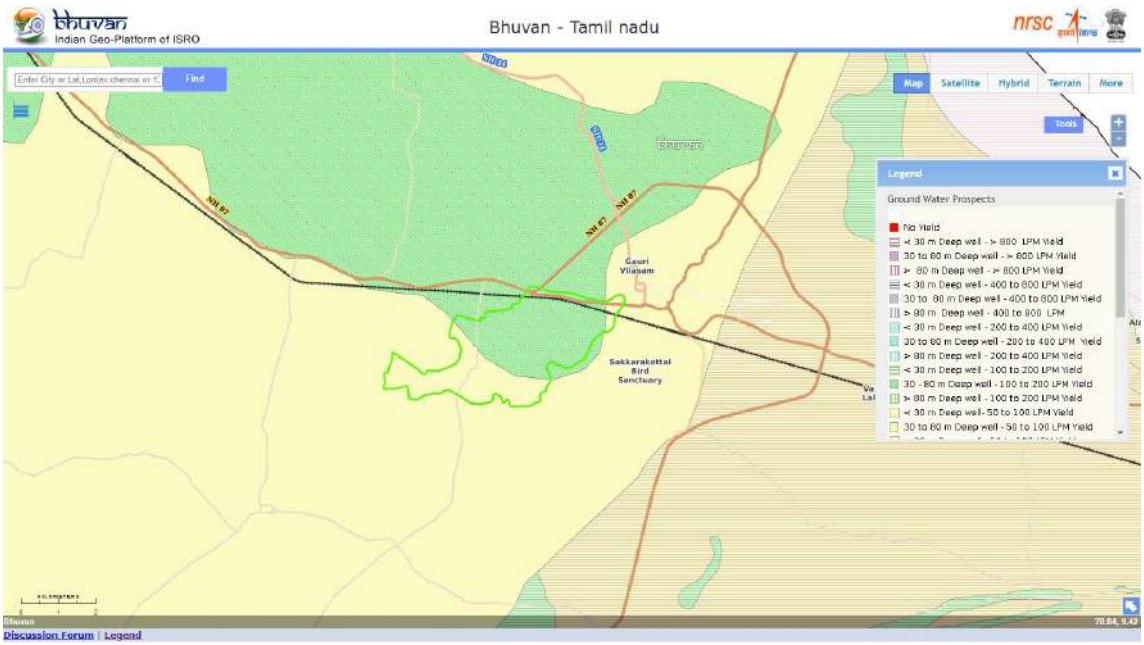
TABLE 44. GENERAL DESCRIPTION OF PUTHENDAL GP, RAMANATHAPURAM BLOCK



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 Koravalli GP shown in Figure 8.6 (A, B, C,D) and discussed below,





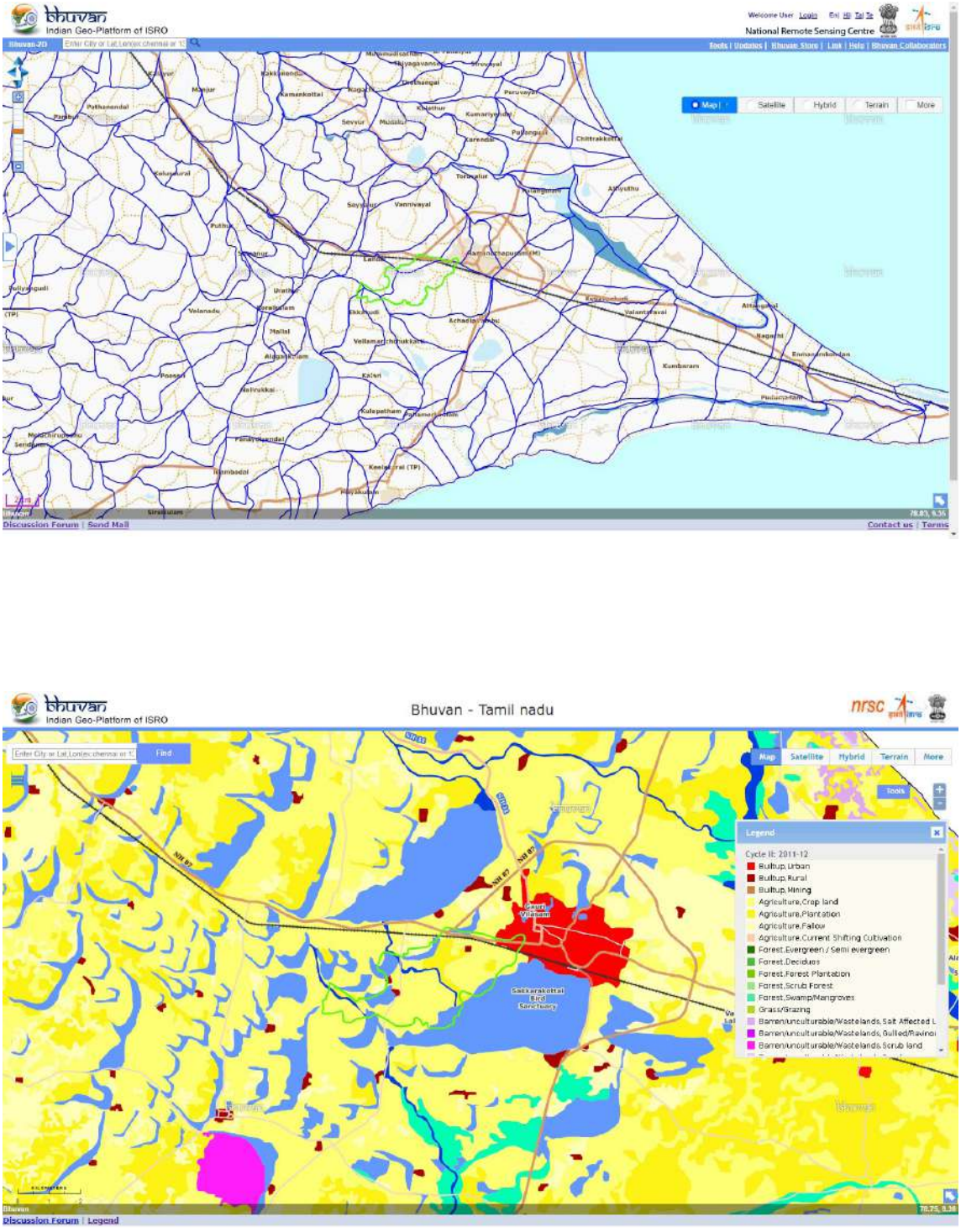


Figure 8.6. Spatial thematic maps of Puthendal GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. LULC

Puthendal GP engrossed with younger coastal plain landform unit (A). It is observed that the groundwater prosperity is available in less than 30 m deep well with yield between 30 to 50 LPM and also the GW prosperity is 30-80 m deep well and 100 to 200 LPM yield (B). GP area is falls under four micro-watershed units (C). Most of land used for crop cultivation (D).

8.3.2 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covered four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 45). 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 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 the GP as the lowest unit of planning and execution.

TABLE 45. NON-SPATIAL DATA - PUTHENDAL GP

Key CWRM Parameter	Details
Climate Vulnerability Area (CVA) 1: Socio-Economic	
Geographical Area (ha)	1,144
Male Population	1,094
Female Population	1,105
Total Population	2,199
SC Population	835
ST Population	0
Vulnerable Population	835
Households (HH's)	507
Only one room HH's (SECC)	76
Female Headed HH's (SECC)	39
Vulnerable Households (SECC)	65
% of Vulnerable Households	13
Registered MGNREGA Job cards	558
The active person working in job Cards	476
Drinking Water Sources	34
HH's have tap water connection for drinking water	250
HH's dependent on other sources for drinking water	0
Annual Greywater Generation (ha.m)	4
Climate Vulnerability Area (CVA) 3: Water Resources	
Canal Network (m)	
Length of Main Canal	3,400
Length of Minor Canal	5,200
Length of Distributaries	1,000
Water Courses (Field Channels)	7,500
No. of Tanks (PWD & Union)	1
No. of Ooranis	9

Irrigation Facilities (ha)	
Area under Tank Irrigation	607.63
Area under Open & Tube Well Irrigation	42.3
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	42.6
Bad Catchment Area	108.2
Watershed and Drainage Networks	
Length of Natural Drainage Lines (km)	7953
No. of Natural Drainage Lines	5
No. of Micro Watersheds	7
Water Demand (ha.m)	
Water Demand For Humans	6
Water Demand for Livestock	1
Water Demand For Agriculture	732
% G.W Utilization for Drinking	62
% G.W Utilization for Livestock	55
% G.W Utilization for Agriculture	7
% SW Utilization for Drinking	38
% SW Utilization for Livestock	45
% SW Utilization for Agriculture	93
Climate Vulnerability Area 4: Agriculture	
Area Under Land Resources (ha)	
Area under Non-Agricultural Uses	148.34
Area under Barren & Un-cultivable Land	43.52
Area under Unirrigated Land	302.3
Area Irrigated by Source	649.93
Catchment Area (ha)	
Land under Good Catchment	191.86
Land under Bad Catchment	952.23
Crop Details (ha)	
Irrigated Area	419.25
Rainfed area	115.88
Area under Paddy Cultivation	522.39
Crop Water Requirement - Irrigated condition (ha.m)	616.47
Crop Water Requirement - Rainfed condition (ha.m)	115.23
Soil Resources: Status of Available Nitrogen (%)	
Very Low (VL)	2
Low (L)	97

Medium (M)	2
Status of Organic Carbon (%)	
Low (L)	1
Medium (M)	1
High (H)	2
Very High (VH)	97
Status of Soil Micro Nutrients (%)	
Sufficient	63
Deficient	37
Status of Physical condition of the soil (%)	
Neutral (N)	1%
Moderately Alkaline (MAI)	99%
Soil Texture	
% of Fine Soil	11%
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture (ha.m)	169.28
ET Losses (ha.m)	497.06
Means of Water Extraction (%)	
Gravity	55
Lifting	45
Irrigation Methods (%)	
Wild Flooding	93
Control Flooding	7
Livestock (No)	
Cattle Population	140
Sheep Population	50
Goat Population	445
Poultry	1,206
Livestock Water Requirement (ha.m)	0.92

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. Female population is more than male population
2. 37% percent of the population belongs to the SC category and according to SECC data
3. 13% of the households are vulnerable, 39 HH are female headed
4. 76 HH have only one room
5. 4 ha.m grey water from 507 households living on the coast needs attention

Water

1. No major, minor canals, distributaries in this GP
2. 1 tank and 9 ooranis in the GP
3. Drinking water depends on 62% of ground-water
4. 93% of surface water utilized for agricul-ture
5. More water for agriculture (732 ha.m)
6. 150.8 ha.m of water is an available runoff in which 28.24% of the runoff is from the good catchment, 71.75% of the conserva-tion is from the bad catchment.

Agriculture and Allied Sector

1. 83.23 % is under Individual land
2. More bad catchment area (71.75%)
3. Rainfed area (60%)
4. Low soil Nitrogen and High carbon
5. 99 % moderately alkaline soil
6. 11% fine soil
7. 93% Wild flooding
8. Area under paddy cultivation 522.39 ha

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 measures to reduce the vulnerability in the GP. About 14.27% of the total land area is taken for WASCA activities like plantation, conservation works. The total proposed area for treatment is 163.3 ha out of which 75.8% of the proposed work in under individual lands (Figure 8.7). Through the proposed conservation activities, 33.92 ha.m run off would be harvested in which, about 42.54 % of the run-off is from the bad catchment, 57.45% of the run off is from the good catchment (Figure 8.8).

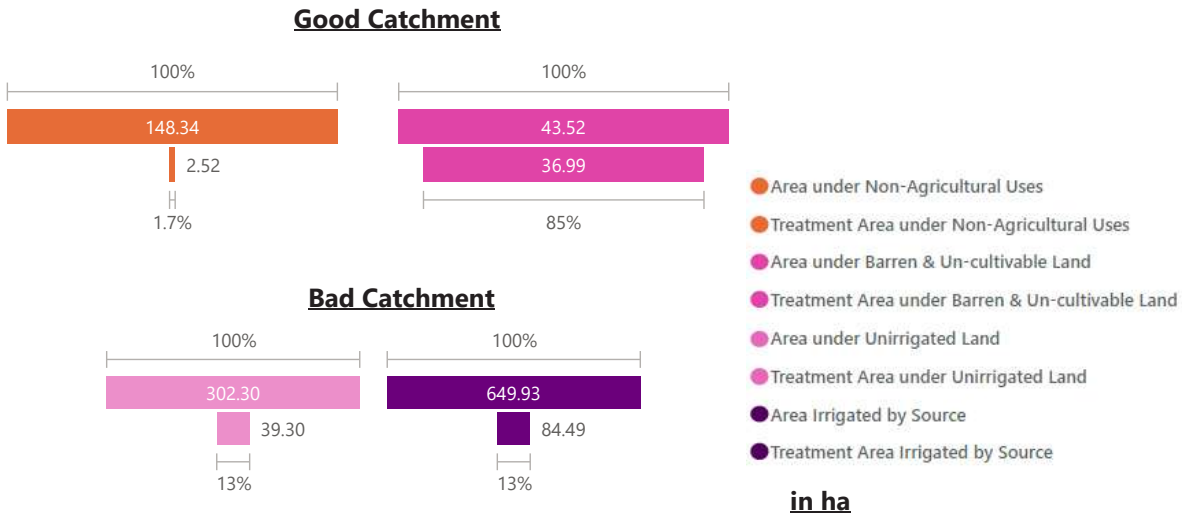


Figure 8.7. Proposed land resource treatment area in Puthendal GP

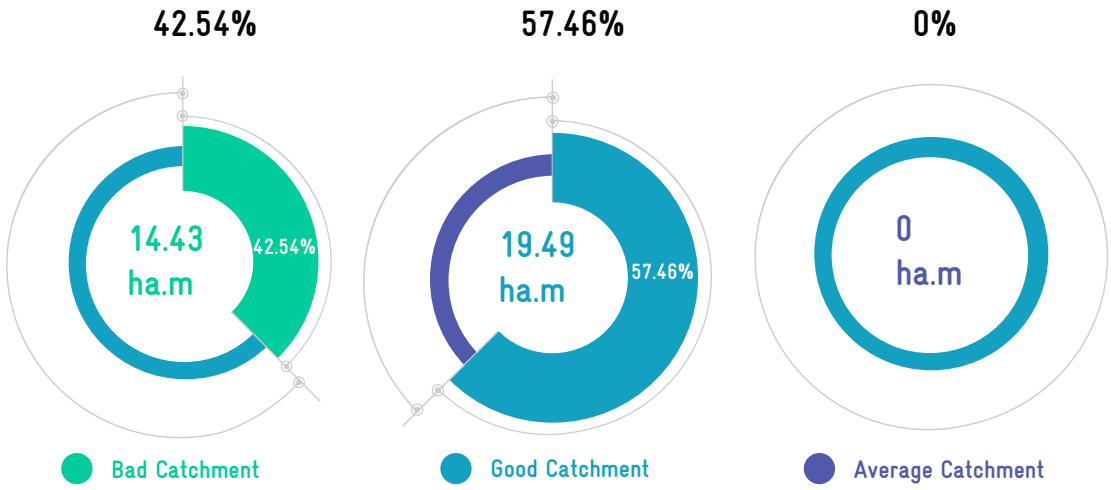


Figure 8.8. Expected run off conservation after treatment in Puthendal GP

Table 46 shows the detailed perspective plan and estimates of the work, budget, and person-days for three years from 2021-2022 to 2023-2024 in the Puthendal GP. Since it is a vulnerable village, attention was given to include appropriate works to improve the common and public land development.

TABLE 46. PERSPECTIVE PLAN OF PUTHENDAL GP - FY (2021-2024)

CWRM Water Action 1: Improvement of Public & Common Lands Development				
CWRM Water Action 1: Works in Upper& Middle Ridge				
Name of the Work	**Ridge Type**	**No of Works**	**Estimated cost (INR in Lakhs)**	**Estimated Person Days**
Afforestation in Public/common lands	Lower ridge	39.52	339.87	1,32,154.88
Contour Continuous Bunds (CCB) for Afforestation area		158.06	3.95	1,580.6
Composting		16	2.72	240
Drainage Line Treatment (m)		0	0.83	324.5048
Avenue plantation (km)		1	2.52	983
Deepening of water bodies		10	23	2,600
Artificial Recharge Structure (No. of units)		17	42.5	6,647
Subtotal Water Action – I		**242**	**415**	**1,44,530**
CWRM Water Action 2: Agricultural and allied Sector development				
CWRM Water Action 2: Works in Lower Ridge				
Farm Bunding (ha)	Lower ridge	124	185.69	72,541
Micro Irrigation (ha)		34	34	0
Construction of farm ponds (No.)		16	32	12,496
Land development (ha)		20	196.5	76,753
Cattle Shelters (No.)		4	8.48	1,324
Goat Sheep Shelters (No.)		61	138.47	21,655
Fodder development for cattle (No.)		4	5.92	9,376
Azolla units (No.)		4	0.6	92
Cattle Trough (No.)		4	0.2	24
Poultry shed (No.)		30	2.7	300
Dry land Horticulture/Agro-forestry (ha)		62	527	2,05,902
Vermi Compost (No.)		4	0.72	108
Subtotal Water Action – II		**366**	**1,132**	**4,00,571**

CWRM Water Action 3: Rural Water Management				
CWRM Water Action 3: Works in Lower Ridge				
Soak pits (Community)	Lower ridge	5	0.65	100
Soak pits (Individual)		53	5.3	848
Roof rain Water Harvesting		2	8	1,250
Community Tanka (Rajasthan Model)		1	30	300
Subtotal Water Action – III		**61**	**43.95**	**2,498**
Overall Total GP		**670**	**1,592**	**5,47,599**

Water actions

Regarding CWRM themes, of the total number of projects identified, 36.11% works are in public and common land, 54.62 % in agriculture and allied sector while it is 9.10 % under rural infrastructure. (Table 47).

TABLE 47. 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	242	415	1,44,530
Agriculture and Allied sector development	366	1,132	4,00,571
Rural water management	61	43.95	2,498
TOTAL	670	1,592	5,47,599

8.3.5 IMPACTS

The proposed water actions based on the above key water challenges cover three years from 2021-2022 to 2023-2024. At the end of the implementation period the following impacts are envisaged (Table 48). It is expected that the impacts have potentially reduced the vulnerability and improved the resilience of the system to the projected climatic change events and ensured water security.

TABLE 48. 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	10 water bodies restored
2	Area under afforestation	2	39.52 ha area under afforestation
3	Quantum of water harvested/recharge	3	33.9 ha.m surface runoff is harvested due to WASCA interventions
4	The proportion of land treated under WASCA	4	14 percent of the total area treated under WASCA (55.05 ha)
5	Drainage Line Treatment	5	Nil

10 TRADITIONAL WATER BODIES RESTORED

39.52 ha AFFORESTATION

33.9 ha.m RUNOFF HARVESTED

14 % AREA OF THE VILLAGE TREATED

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR		OUTCOMES/ IMPACT
1	Assessment of sources of water for live-stock and agriculture demand	1	16 Farm ponds established
2	No structures were established for on-farm (in-situ) water harvesting in drylands	2	16 compost units for soil health improve-ment
3	Improvement in soil health	3	123.79 ha Farm bunding with trenches
4	Changes in the irrigation practices	4	62 ha under dryland horticulture
5	Dryland development with agro-forestry	5	4 vulnerable households established fodder plots
6	Households established fodder plots		

16 FARM PONDS

16 VERMI COMPOST

123.79 ha FARM BUNDING

62 ha DRYLAND HORTICULTURE

4 FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

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

OUTCOMES/ IMPACT	
1	5 common and 53 individual soak pits were established for recycling greywater benefiting 530 households
2	2 common roof rainwater harvesting and storage

5 COMMUNITY &
53 INDIVIDUAL SOAK PITS

2
COMMON ROOF RAINWATER HARVESTING

Table 49 provides both the prospective plan for three years and the annual plan for the one year from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 49. PROPOSALS FOR THE MGNREGS, PUTHENDAL GP, RAMANATHAPURAM BLOCK

	No of works	No of person days
Perspective plan	670	5,47,599
Annual plan	268	2,19,040

8.3.6 PROPOSED ACTIVITY MAP

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

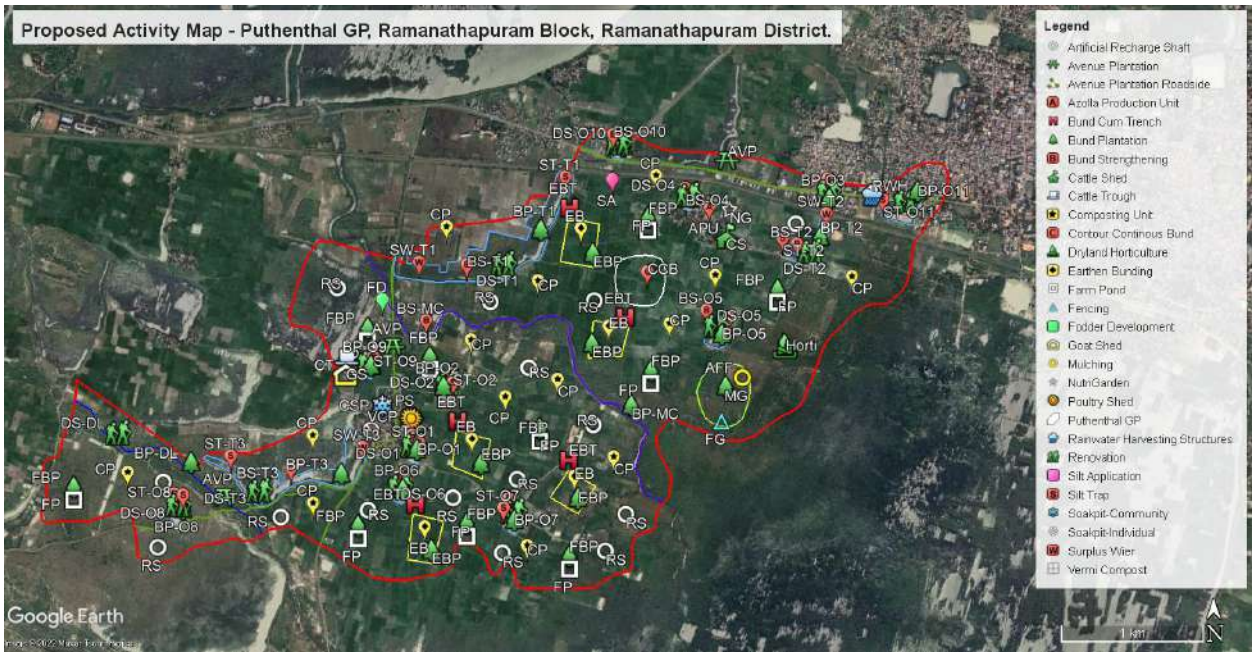
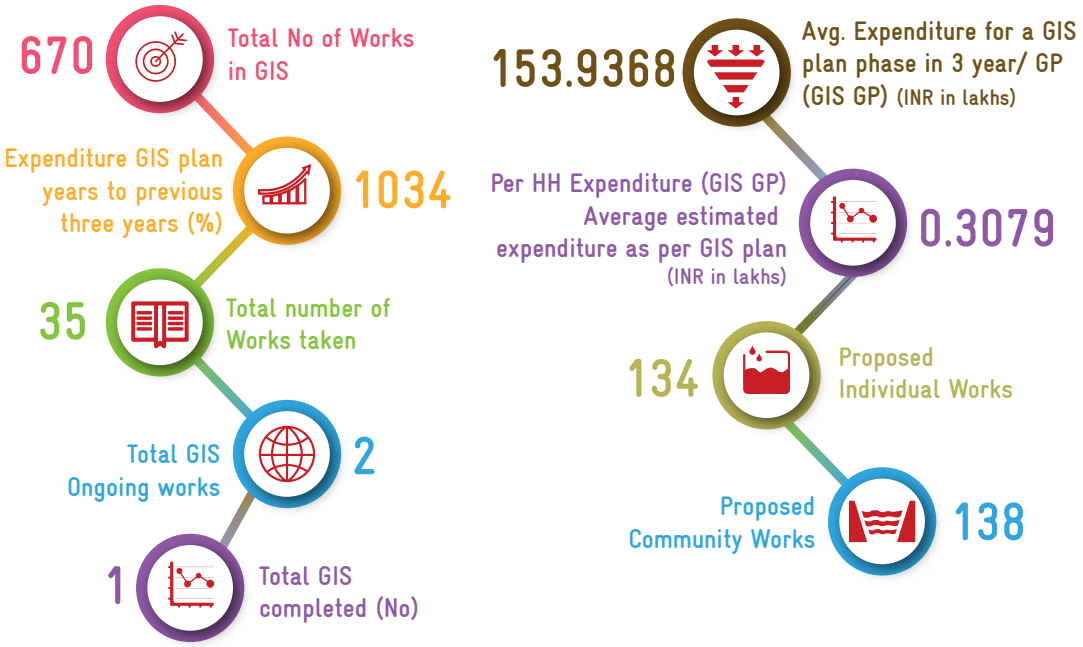


Figure 8.9. Proposed Activity map of Puthendal GP

8.3.7 GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Puthendal GP) in Ramanathapuram Block is represented in Table 50.

TABLE 50. GIS PLAN IMPLEMENTATION, KEY PARAMETERS PERFORMANCE IN NUMBERS



நீர்இன்று அமையாது உலகெனின் யார்யார்க்கும்
வான்இன்று அமையாது ஒழுக்கு

குறள் - 20

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

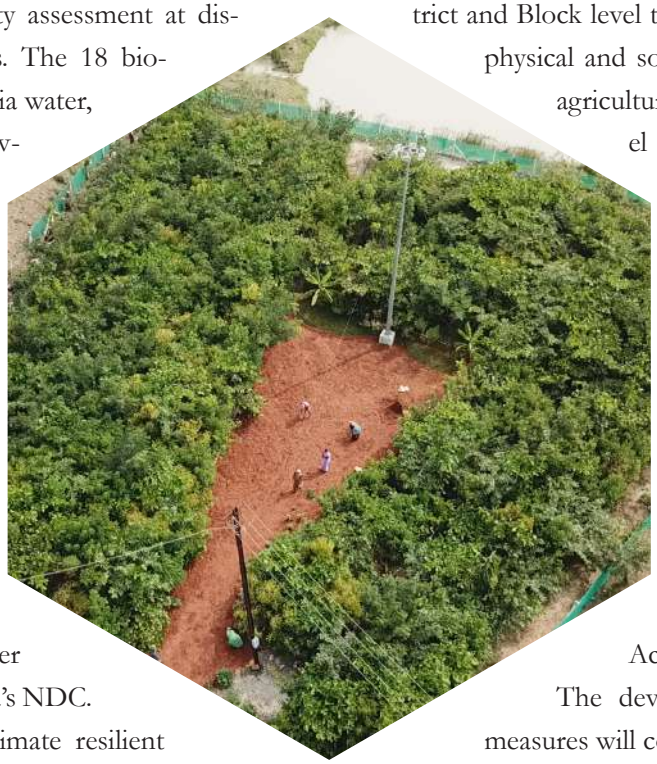
Thirukkural - 20

CHAPTER 9

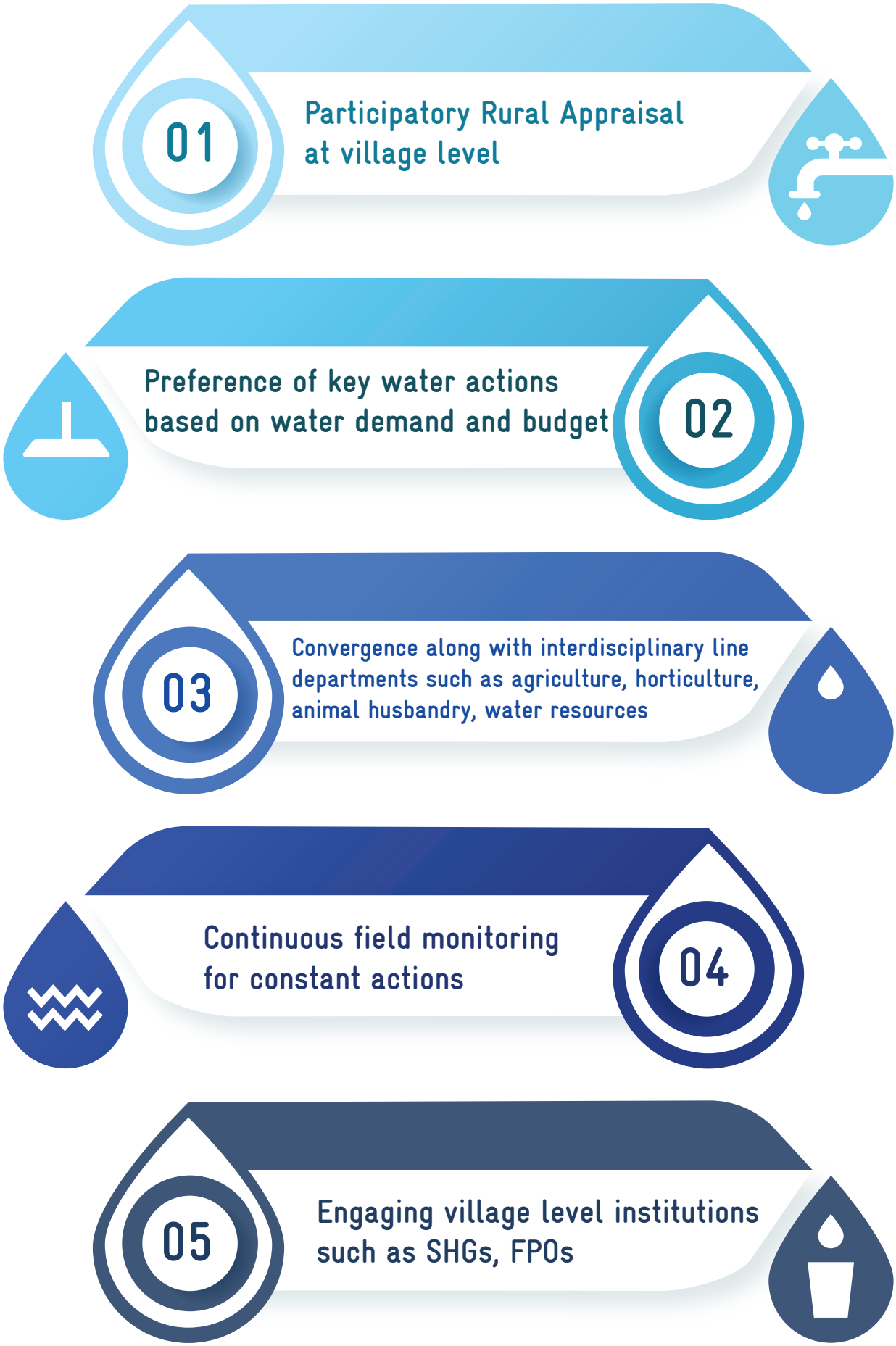
CONCLUSION

"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"

In recent decades, the demand for water is increasing at a fast rate due to rapid increase in population, industrial and economic growth. The evident changes in climate 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 which resulted in lowering of ground water levels and even drying up of wells. 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. The 18 bio-physical and socio-economic indicators 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 the above mentioned four 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 drawn up under WASCA initiatives in public and common land, agriculture and allied sector, rural infrastructure areas. All the indicators/parameters and Key Water Action are aligned to the 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 based on macro and micro-watershed enables to adopt an ecosystem approach in promoting nature-based solutions. The productive impacts are visualized through a 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 outcome are:


01
Participatory Rural Appraisal at village level
Preference of key water actions based on water demand and budget
02
03
Convergence along with interdisciplinary line departments such as agriculture, horticulture, animal husbandry, water resources
Continuous field monitoring for constant actions
04
05
Engaging village level institutions such as SHGs, FPOs

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	*https://censusindia.gov.in/2011census/dchb/DCHB.html*
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 (ha.m)
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 ha.m	**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 SO_4^{2-} assumed

ANNEXURE 3.7

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

Gram Panchayat	Canal Irrigation				Tradational Water bodies	
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distrib-utaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)
Achchundanvayal	800	2,000	7,000	5,000	2	6
Chitoor	2,000	1,500	2,000	2,000	4	5
Athyuthu	1,500	4,000	10,500	13,000	3	25
Chittrakottai	1,000	1,500	1,000	13,000	2	28
Ilamanoor	800	2,000	7,000	5,000	6	5
Madhavanur	-	15,000	6,000	6,500	-	9
Puthendal	3,400	5,200	1,000	7,500	1	2
Naranamangalam	-	1,300	1,000	24,000	-	13
Pullangudi	3,000	1,500	1,000	10,000	1	8
Peruvayal	1,500	1,000	1,000	8,000	3	5
Thoravallur	1,500	1,500	-	3,500	1	6
Surankottai	500	-	3,200	1,000	2	6
Kavanur	4,000	-	-	-	1	4
Karukudi	364	-	-	241	1	3
Thiruvolhiyakalugoorani	-	-	-	-	-	11
Madakottan	-	-	-	3,000	-	8
Paravoor	-	1,500	500	6,000	2	9
Kalanikudi	1,000	600	300	8,000	1	3
Devipattinam	-	90,000	90,000	500	3	13
Sakkarakottai	-	-	-	-	1	3
Therkutharavai	1,200	1,500	600	2,000	1	14
Karendal	12,000	-	6,000	7,500	2	7
Rajasuriyamadai	-	-	-	-	2	13
Pandamangalam	10,000	-	500	5,000	7	6
Vennathur	7,000	3,000	-	22,000	7	20

Gram Panchayat	Irrigation Facilities (ha)			Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Tank Irrigation	Canal Irrigation	Open & Tube Well Irrigation	Good Catchment Area	Average Catchment Area	Bad Catchment Area	Length of Natural Drainage Lines (m)	Number of Natural Drainage Lines (No.)	Number of Micro-watersheds (No.)
Achchundanvayal	106	3	10	47	40	15	1,016	3	5
Chitoor	58	-	8	38	15	54	1,108	3	3
Athyuthu	145	-	-	44	81	56	2,016	3	5
Chittrakottai	64	-	284	106	133	97	4,103	5	11
Ilamanoor	32	-	-	79	29	127	19,133	12	9
Madhavanur	106	-	375	93	46	76	2,815	5	9
Puthendal	608	-	42	43	-	108	7,953	5	7
Naranamangalam	223	-	62	78	82	87	1,744	2	10
Pullangudi	189	-	11	57	102	48	4,986	4	8
Peruvayal	315	-	46	82	57	60	11,391	11	10
Thoravallur	746	-	71	33	-	94	2,572	2	7
Surankottai	345	-	15	31	103	56	2,314	2	6
Kavanur	96	-	105	37	45	37	3,671	3	9
Karukudi	61	-	-	16	19	16	-	-	4
Thiruvolhiyakalugoorani	22	-	96	57	86	60	4,214	4	5
Madakottan	-	8	-	19	29	20	825	2	5
Paravoor	40	-	-	33	-	55	-	-	8
Kalanikudi	158	-	146	12	7	8	-	-	3
Devipattinam	270	-	32	93	59	67	11,648	9	4
Sakkarakottai	56	-	22	21	26	13	-	-	7
Therkutharavai	346	-	26	116	144	71	668	1	12
Karendal	-	214	-	80	6	37	5,962	7	5
Rajasuriyamadai	16	-	-	78	260	86	3,365	7	9
Pandamangalam	101	-	50	20	1	8	-	-	2
Vennathur	409	-	59	160	135	74	3,244	5	9

Gram Panchayat	Water Demand								
	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)	% GW Utilization for Drinking (%)	% GW Utilization for Livestock (%)	% GW Utilization for Agriculture. (%)	% SW Utilization for Drinking (%)	% SW Utilization for Livestock (%)	% SW Utilization for Agriculture (%)
Achchundanvayal	8	1	109	59	47	9	41	53	91
Chitoor	5	2	315	95	66	13	5	34	87
Athyuthu	7	1	298	26	67	-	74	33	100
Chittrakottai	23	3	515	34	59	82	66	41	18
Ilamanoor	3	1	67	-	85	-	100	15	100
Madhavanur	5	1	839	86	65	78	14	35	22
Puthendal	6	1	732	62	55	7	38	45	93
Naranamangalam	5	1	815	81	75	22	19	25	78
Pullangudi	4	1	384	90	76	6	10	24	94
Peruvayal	4	1	767	91	71	13	9	29	87
Thoravallur	7	1	389	74	90	9	26	10	91
Surankottai	16	3	148	100	82	4	-	18	96
Kavanur	8	1	231	89	87	52	11	13	48
Karukudi	8	0	257	100	87	-	-	13	100
Thiruvolhiyakalugoorani	11	3	387	100	84	82	-	16	18
Madakottan	11	1	718	100	84	-	-	16	100
Paravoor	13	1	149	92	87	-	8	13	100
Kalanikudi	3	1	463	89	65	48	11	35	52
Devipattinam	30	2	463	90	65	11	10	35	89
Sakkarakottai	13	2	263	92	78	28	8	22	72
Therkutharavai	13	6	273	99	60	7	1	40	93
Karendal	4	0	314	100	70	-	-	30	100
Rajasuriyamadai	14	3	798	100	78	-	-	22	100
Pandamangalam	4	0	39	91	94	33	9	6	67
Vennathur	9	2	728	78	86	13	22	14	87

ANNEXURE 3.8

LOCATION WISE WATER QUALITY IN RAMANATHAPURAM BLOCK DURING PRE-MONSOON SEASON

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Chittarkottai	Chittarkottai	E 78° 53' 54.01"	N 9° 25' 41.675"	Open well	7.1	0	2,844	1,722	316
Devipattinam	Agri-farm	E 78° 53' 7.688"	N 9° 27' 31.37"	Bore well	6.31	4	28,470	17,230	248
Devipattinam	Devipattinam	E 78° 53' 37.543"	N 9° 29' 14.06"	Open well	7.12	5	17,340	10,860	442
Ilamanoor	NearPalangulam (Farm)	E 78° 51' 40.802"	N 9° 24' 44.575"	Bore well	6.81	0	6,990	4,300	293
Ilamanoor	Ramanathapuram Bypass	E 78° 51' 27.011"	N 9° 23' 1.878"	Bore well	7.61	0	678	388	419
Kalanikudi	SakkaravalaNallur	E 78° 52' 5.639"	N 9° 27' 20.408"	Open well	7.55	0	1,770	1,075	408
Madakottan	Near Ramalan Nagar	E 78° 52' 42.701"	N 9° 22' 44.317"	Bore well	7.42	0	1,360	820	391
Madakottan	Ramalan Nagar	E 78° 52' 20.053"	N 9° 22' 39.677"	Open well	6.85	0	3,987	2,494	299
Madhavanoor	Madhavanoor	E 78° 52' 2.96"	N 9° 29' 36.64"	Open well	7.51	0	811	455	405
Nagarathamangalam	ABC Kenbridge School	E 78° 52' 36.584"	N 9° 30' 58.327"	Open well	7.36	0	3,614	2,264	367
Nagarathamangalam	Vaigai	E 78° 50' 24.101"	N 9° 30' 14.472"	Bore well	7.44	0	3,075	1,837	394
Puthendhal	Kooriyur	E 78° 47' 22.042"	N 9° 20' 58.744"	Bore well	6.9	0	6,680	4,240	301
R S Madai	Vannikudi	E 78° 47' 4.924"	N 9° 19' 47.932"	Open well	7.29	0	956	578	350
Ramanathapuram	Ramanathapuram	E 78° 48' 41.695"	N 9° 21' 58.464"	Bore well	6.96	0	3,224	1,911	305
Surankottai	Soorankottai	E 78° 48' 58.874"	N 9° 22' 48.4"	Bore well	6.9	0	7,610	4,780	301
Therku Tharavai	Ammankovil	E 78° 50' 54.442"	N 9° 20' 0.326"	Open well	7.41	0	736	466	387
Therku Tharavai	Sethunagar	E 78° 50' 33.706"	N 9° 21' 21.841"	Open well	7.64	0	1,513	855	432
Toruvalur	Ramanathapuram Bypass	E 78° 50' 14.078"	N 9° 23' 43.642"	Bore well	7.04	0	4,810	3,000	312
Toruvalur	Thoruvalur	E 78° 48' 49.406"	N 9° 24' 36.331"	Bore well	7.75	0	1,605	901	445
Vani	Vani	E 78° 54' 24.653"	N 9° 20' 56.911"	Bore well	7.11	0	3,941	2,479	317
Vennathur	Pathanandhal	E 78° 54' 37.483"	N 9° 32' 1.018"	Bore well	7.3	0	2,812	1,706	351

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
Chittarkottai	68	235	400	160	179	149	6	47	721	15	186.6	0.45
Devipattinam	69	161	3,394	1,551	869	3,172	22	29	6,283	26	1554.2	3.59
Devipattinam	108	311	2,563	1,147	785	909	13	11	5,274	9	1065.2	2.45
Ilamanoor	69	190	833	381	213	967	8	31	2,554	9	474	1.36
Ilamanoor	96	288	390	280	45	53	23	18	522	18	104.5	0.26
Kalanikudi	112	265	211	96	54	297	6	19	382	26	120.6	0.28
Madakottan	106	254	162	74	42	218	4	36	331	8	95.3	0.27
Madakottan	94	194	475	217	122	79	2	43	598	16	191.3	0.36
Madhavanoor	89	293	197	144	25	96	7	15	143	13	65.3	0.12
Nagarathamangalam	68	269	431	197	110	537	16	24	1,260	26	256.8	0.71
Nagarathamangalam	96	286	367	168	94	296	13	37	876	25	195.1	0.51
Puthendhal	66	196	796	364	204	1,073	9	32	1,800	2	424	1.12
R S Madai	92	228	114	52	29	92	8	19	142	14	62	0.13
Ramanathapuram	95	198	384	176	98	571	6	43	914	4	214.5	0.63
Surankottai	58	226	907	415	232	564	6	31	1,593	11	406.8	0.88
Therku Tharavai	112	252	88	40	23	115	5	8	186	7	58.2	0.13
Therku Tharavai	141	266	250	40	90	241	4	3	416	2	108.7	0.26
Toruvalur	88	209	573	262	147	766	15	12	1,590	32	332.8	0.89
Toruvalur	109	309	191	87	49	176	3	36	401	49	112.2	0.29
Vani	45	236	470	215	120	632	13	42	1,124	3	51.5	0.73
Vennathur	84	228	335	153	86	236	16	43	752	18	174.1	0.46

ANNEXURE 3.9

LOCATION WISE WATER QUALITY IN RAMANATHAPURAM BLOCK DURING POST-MONSOON SEASON

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Chittarkottai	Chittrakottai	E 78° 53' 54.01"	N 9° 25' 41.675"	Open well	7.06	0	1,975	1,225	216
Devipattinam	Agri-farm	E 78° 53' 7.688"	N 9° 27' 31.37"	Bore well	6.56	2	9,130	5,661	621
Devipattinam	Devipattinam	E 78° 53' 37.543"	N 9° 29' 14.06"	Open well	6.73	0	3,850	2,387	318
Ilamanoor	NearPalangulam (Farm)	E 78° 51' 40.802"	N 9° 24' 44.575"	Bore well	6.94	0	5,264	3,264	374
Ilamanoor	Ramanathapuram Bypass	E 78° 51' 27.011"	N 9° 23' 1.878"	Bore well	6.6	1	6,110	3,788	414
Kalanikudi	SakkaravalaNallur	E 78° 52' 5.639"	N 9° 27' 20.408"	Open well	7.51	0	2,478	1,536	213
Madakottan	Near Ramalan Nagar	E 78° 52' 42.701"	N 9° 22' 44.317"	Bore well	6.93	0	1,156	717	204
Madakottan	Ramalan Nagar	E 78° 52' 20.053"	N 9° 22' 39.677"	Open well	6.84	0	1,582	981	153
Madhavanoor	Madhavanoor	E 78° 52' 2.96"	N 9° 29' 36.64"	Open well	7.23	0	552	342	114
Nagarathamangalam	ABC Kenbridge School	E 78° 52' 36.584"	N 9° 30' 58.327"	Open well	7.52	0	1,142	708	167
Nagarathamangalam	Vaigai	E 78° 50' 24.101"	N 9° 30' 14.472"	Bore well	7.11	0	3,821	2,369	842
Puthendhal	Kooriyur	E 78° 47' 22.042"	N 9° 20' 58.744"	Bore well	6.67	0	1,688	1,047	216
R S Madai	Vannikudi	E 78° 47' 4.924"	N 9° 19' 47.932"	Open well	6.98	0	546	339	161
Ramanathapuram	Ramanathapuram	E 78° 48' 41.695"	N 9° 21' 58.464"	Bore well	6.95	0	3,986	2,471	458
Surankottai	Soorankottai	E 78° 48' 58.874"	N 9° 22' 48.4"	Bore well	7.03	0	3,934	2,439	375
Therku Tharavai	Ammankovil	E 78° 50' 54.442"	N 9° 20' 0.326"	Open well	7.45	0	456	283	124
Therku Tharavai	Sethunagar	E 78° 50' 33.706"	N 9° 21' 21.841"	Open well	7.45	0	430	267	104
Toruvalur	Ramanathapuram Bypass	E 78° 50' 14.078"	N 9° 23' 43.642"	Bore well	6.98	0	3,775	2,341	348
Toruvalur	Thoruvalur	E 78° 48' 49.406"	N 9° 24' 36.331"	Bore well	6.89	0	2,527	1,567	267
Vani	Vani	E 78° 54' 24.653"	N 9° 20' 56.911"	Bore well	6.8	0	5,850	3,627	426
Vennathur	Pathanandhal	E 78° 54' 37.483"	N 9° 32' 1.018"	Bore well	6.25	0	3,607	2,236	304

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
Chittarkottai	42	167	99	46	41	89	28	96	136	12	89.4	0.309
Devipattinam	131	482	573	311	246	313	71	186	617	49.686	368.4	3.745
Devipattinam	56	251	267	146	103	210	46	135	344.9	16	176.4	1.233
Ilamanoor	75	285	399	170	215	307	50	149	523	28.648	255.1	1.409
Ilamanoor	88	321	379	187	169	291	58	155	547.4	34	265.9	0.487
Kalanikudi	36	163	210	83	113	139	23.5	82	214	13.481	127.7	0.497
Madakottan	17	173	88	37	42	57	11	76.67	103.6	6.293	64.1	0.347
Madakottan	23	126	135	73	56	69	15	59	198	8.61	86	0.239
Madhavanoor	8	99	49	19	17	13	3	17	37	3.002	33.3	0.134
Nagarathamangalam	16	136	76	37	21	53	10.8	26	86	6.214	56	0.617
Nagarathamangalam	73	287	273	123	138	246	36.3	154	469	20.792	194.1	0.69
Puthendhal	45	156	137	52	71	70	10	86	113	15	86.3	1.237
R S Madai	28	117	51	27	16	31	6	31	51	5	36.7	0.148
Ramanathapuram	113	333	312	135	158	186	24	21	361	32	186.6	0.804
Surankottai	56	311	282	147	121	183	37.4	163	356	21.407	183.6	0.913
Therku Tharavai	17	87	43	22	13	19	3	22	41	6	32.6	0.159
Therku Tharavai	13	77	44	16	17	23	2	16	52	8	33.5	0.288
Toruvalur	54	278	275	122	146	226	35.9	143	416	32	191.7	1.135
Toruvalur	36	221	169	96	62	112	24	93	189	13.753	114.7	0.364
Vani	95	317	374	176	193	246	57	164	553	36	263.4	1.092
Vennathur	52	243	259	116	128	218	34.3	121	323.1	19.625	171.9	0.526

ANNEXURE 3.10

GP WISE STATUS OF AGRICULTURE RESOURCE

Gram Panchayat	Land Resources (ha)							
	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source
Achchundanvayal	173.24	37.90	229.63	5.15	-	0.22	15.70	116.20
Chitoor	110.78	60.25	71.25	19.15	14.12	5.25	386.42	66.34
Athyuthu	83.27	115.16	445.72	29.00	-	-	343.95	145.49
Chittrakottai	363.31	112.15	752.55	25.50	-	5.80	499.67	347.84
Ilamanoor	195.00	159.67	145.17	25.00	12.06	175.00	900.52	32.18
Madhavanur	362.78	56.10	207.40	61.16	56.73	106.44	128.88	374.65
Puthendal	148.34	43.52	-	-	-	-	302.30	649.93
Naranamangalam	250.63	99.10	445.78	35.10	37.73	30.18	412.79	285.59
Pullangudi	228.82	30.05	546.05	55.16	58.88	96.52	66.83	200.55
Peruvayal	286.42	85.15	279.03	55.84	44.21	48.80	74.66	361.71
Thoravallur	149.58	-	-	-	-	742.09	17.27	70.60
Surankottai	59.65	79.40	577.52	29.00	36.78	69.56	25.63	360.66
Kavanur	127.11	38.54	222.38	42.70	8.22	98.24	113.19	104.95
Karukudi	54.48	16.15	95.31	18.30	3.52	42.10	48.51	44.98
Thiruvolhiyakalugoorani	183.69	74.39	486.62	18.76	-	21.59	413.00	96.44
Madakottan	61.23	24.79	162.20	6.26	-	7.20	137.98	32.15
Paravoor	150.78	-	-	-	54.31	326.60	79.10	20.11
Kalanikudi	38.25	13.44	36.88	6.05	9.90	3.98	25.44	33.36
Devipattinam	309.48	108.71	298.36	48.95	80.10	32.16	205.82	269.88
Sakkarakottai	36.52	55.70	134.58	15.00	3.00	22.22	29.19	55.86
Therkutharavai	206.96	315.62	762.61	85.03	17.00	125.89	165.39	316.51
Karendal	331.27	27.22	19.85	14.01	-	80.52	79.97	161.03
Rajasuriyamadai	273.28	76.45	1494.60	32.20	-	-	464.19	292.29
Pandamangalam	88.21	-	6.48	-	-	14.66	29.10	27.71
Vennathur	569.33	150.34	711.62	80.30	0.03	78.31	103.33	468.24

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catch-ment	Bad Catch-ment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Require-ment - Irrigated con-dition (ha.m)	Crop Water Require-ment - Rainfed condi-tion (ha.m)
Achchundanvayal	211.14	234.78	132.12	75.28	13.30	65.26	100.86	8.06
Chitoor	171.03	90.40	472.13	66.07	224.03	276.59	95.09	220.25
Athyuthu	198.43	474.72	489.44	157.84	187.58	185.21	145.77	152.59
Chittrakottai	475.46	778.05	853.31	325.01	353.55	335.07	179.72	335.57
Ilamanoor	354.67	170.17	1119.76	20.49	38.28	54.51	29.38	37.25
Madhavanur	418.88	268.56	666.70	391.66	258.97	638.91	582.49	256.53
Puthendal	191.86	-	952.23	419.25	115.88	522.39	616.47	115.23
Naranamangalam	349.73	480.88	766.29	290.75	383.65	667.64	432.48	382.56
Pullangudi	258.87	601.21	422.78	196.46	89.90	285.56	294.47	89.69
Peruvayal	371.57	334.87	529.38	364.19	224.20	582.92	543.21	223.36
Thoravallur	149.58	-	829.96	256.19	50.61	256.66	344.04	44.87
Surankottai	139.05	606.52	492.63	98.37	1.75	98.30	146.10	1.55
Kavanur	165.65	265.08	324.60	153.65	89.13	143.53	151.98	78.97
Karukudi	70.63	113.61	139.11	137.89	106.85	143.53	164.98	92.49
Thiruvolhiyakalugoorani	258.08	505.38	531.03	253.82	50.93	256.66	342.20	44.71
Madakottan	86.02	168.46	177.33	532.67	45.70	451.73	672.90	45.53
Paravoor	150.78	-	480.12	58.04	92.54	118.49	56.23	92.34
Kalanikudi	51.69	42.93	72.68	295.66	208.24	259.05	312.49	150.73
Devipattinam	418.19	347.31	587.96	295.66	208.24	259.05	312.49	150.73
Sakkarakottai	92.22	149.58	110.27	286.39	82.15	104.26	197.69	65.80
Therkutharavai	522.58	847.64	624.79	286.59	102.40	104.26	197.77	74.90
Karendal	358.49	33.86	321.52	182.76	67.44	208.70	253.40	60.10
Rajasuriyamadai	349.73	1526.80	756.48	379.61	247.22	589.60	560.79	237.69
Pandamangalam	88.21	6.48	71.47	22.51	5.66	28.17	33.77	5.66
Vennathur	719.67	791.92	649.91	390.62	143.19	532.62	585.50	142.93

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Organic Carbon (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	Suffi-cient	Defi-cient
Achchundanvayal	48.65	51.35	-	-	-	51.35	48.65	-	-	-	57.00	43.00
Chitoor	18.75	81.25	-	-	-	59.38	40.63	-	-	-	57.00	43.00
Athyuthu	49.46	50.54	-	-	-	2.15	94.62	3.23	-	-	62.00	38.00
Chittrakottai	99.33	0.67	-	-	-	20.13	73.15	6.71	-	-	65.00	35.00
Ilamanoor	11.11	88.89	-	-	-	-	40.40	49.49	10.10	-	78.00	22.00
Madhavanur	48.34	50.33	0.66	0.66	-	0.66	1.32	0.66	4.64	92.72	61.00	39.00
Puthendal	1.57	96.86	1.57	-	-	-	0.52	0.52	1.57	97.38	63.00	37.00
Naranamangalam	47.69	36.92	3.85	8.46	3.08	1.54	-	-	13.08	85.38	70.00	30.00
Pullangudi	45.00	55.00	-	-	-	-	-	-	100.00	-	68.00	32.00
Peruvayal	95.93	3.25	-	-	0.81	47.97	51.22	0.81	-	-	75.00	25.00
Thoravallur	23.16	69.47	4.21	2.11	1.05	1.05	-	-	2.11	96.84	69.00	31.00
Surankottai	45.68	50.62	3.70	-	-	1.23	1.23	1.23	16.05	80.25	69.00	31.00
Kavanur	32.10	67.90	-	-	-	-	-	-	-	100.00	73.00	27.00
Karukudi	16.43	75.64	7.93	-	-	5.67	12.18	5.67	62.89	13.60	63.00	37.00
Thiruvolhiyakalugoorani	1.88	90.61	7.51	-	-	0.47	-	-	20.19	79.34	79.00	21.00
Madakottan	85.15	13.97	0.44	-	0.44	5.24	87.34	7.42	-	-	69.00	31.00
Paravoor	75.00	25.00	-	-	-	50.00	50.00	-	-	-	72.00	28.00
Kalanikudi	88.89	11.11	-	-	-	10.00	87.78	1.11	1.11	-	72.00	28.00
Devipattinam	99.33	0.67	-	-	-	-	73.15	26.85	-	-	75.00	25.00
Sakkarakottai	69.01	30.99	-	-	-	42.25	57.75	-	-	-	73.00	27.00
Therkutharavai	-	100.00	-	-	-	-	-	100.00	-	-	67.00	33.00
Karendal	60.14	10.87	28.99	-	-	58.70	39.86	1.45	-	-	67.00	33.00
Rajasuriyamadai	45.36	54.64	-	-	-	13.40	9.79	7.22	67.53	2.06	64.00	36.00
Pandamangalam	60.00	40.00	-	-	-	-	-	-	-	100.00	70.00	30.00
Vennathur	5.70	94.30	-	-	-	-	1.90	71.52	26.58	-	68.00	32.00

Gram Panchayat	Status of Physical condition of the soil (%)				Soil Texture (%)			Soil moisture and ET			Means of Water Extraction (%)	
	Moderately Acidic	Slighly Acidic	Neutral	Moderately Alkaline	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting
Achchundanvayal	-	2.70	-	97.30	95.00	-	Moderate	17	68.82	188.72	88	12
Chitoor	-	2.70	-	97.30	65.00	-	Moderate	17	105.87	273.53	75	25
Athyuthu	-	-	-	100.00	92.00	-	Moderate	17	183.48	488.15	97	3
Chittrakottai	-	-	-	100.00	77.00	13.99	Moderate	17	296.40	835.23	22	78
Ilamanoor	44.44	52.53	-	3.03	64.00	19.43	Moderate	17	246.43	562.65	100	-
Madhavanur	1.32	3.97	-	95.00	40.00	39.51	Moderate	17	168.53	371.11	70	30
Puthendal	-	-	0.52	99.00	10.66	-	Moderate	17	169.28	497.06	55	45
Naranamangalam	-	-	5.38	94.62	79.00	17.99	Moderate	17	228.87	597.25	70	30
Pullangudi	-	-	-	100.00	79.73	5.79	Moderate	17	179.19	424.61	50	50
Peruvayal	-	-	-	100.00	72.57	1.46	Moderate	17	161.40	373.44	29	71
Thoravallur	-	2.11	-	98.00	24.82	-	Moderate	17	141.09	45.87	55	45
Surankottai	-	10.00	-	90.00	0.16	-	Moderate	17	200.35	503.11	55	45
Kavanur	38.24	58.82	-	2.94	95.62	-	Moderate	17	106.80	229.95	2	98
Karukudi	23.23	23.23	-	54.00	52.00	-	Moderate	17	45.71	98.55	33	67
Thiruvolhiyakalugoorani	44.13	25.35	-	30.05	78.00	20.67	Moderate	17	188.84	519.94	0	100
Madakottan	-	10.00	-	90.00	71.45	0.35	Moderate	17	63.00	173.48	77	23
Paravoor	25.00	-	-	75.00	61.08	-	Moderate	17	81.62	51.79	69	31
Kalanikudi	1.11	2.22	-	97.00	50.92	24.54	Moderate	17	21.94	49.94	6	94
Devipattinam	1.69	1.69	-	97.00	46.00	35.71	Moderate	17	177.48	404.06	55	45
Sakkarakottai	23.94	18.31	2.82	54.93	71.30	-	Moderate	17	53.64	114.65	40	60
Therkutharavai	-	-	-	100.00	67.00	-	Moderate	17	303.97	649.63	58	42
Karendal	-	1.03	-	99.00	76.00	-	Moderate	17	65.04	136.16	4	96
Rajasuriyamadai	2.63	3.68	0.53	85.26	32.00	-	Moderate	17	401.15	1175.06	13	87
Pandamangalam	100.00	-	-	-	74.70	-	Moderate	17	13.25	33.04	65	35
Vennathur	68.00	6.33	3.80	21.52	75.89	4.64	Moderate	17	270.67	669.83	57	43

Gram Panchayat	Irrigation Methods (%)		Livestock (No.)			
	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population	Poultry
Achchundanvayal	91	9	173	1606	339	564
Chitoor	87	13	271	698	710	366
Athyuthu	100	-	92	-	444	223
Chittrakottai	18	82	460	1393	1738	1197
Ilamanoor	100	-	120	-	206	207
Madhavanur	22	78	248	251	1060	1406
Puthendal	93	7	140	50	445	1206
Naranamangalam	78	22	126	-	403	586
Pullangudi	94	6	269	-	812	562
Peruvayal	87	13	137	34	517	323
Thoravallur	91	9	357	16	361	352
Surankottai	96	4	686	41	804	1727
Kavanur	52	48	241	118	215	370
Karukudi	100	-	103	50	92	158
Thiruvolhiyakalugoorani	16	84	665	265	578	935
Madakottan	100	-	222	88	193	312
Paravoor	100	-	348	338	184	534
Kalanikudi	52	48	91	57	409	788
Devipattinam	89	11	298	187	1405	237
Sakkarakottai	72	28	428	353	660	1025
Therkutharavai	93	7	930	1462	3679	3593
Karendal	96	4	70	174	127	163
Rajasuriyamadai	96	4	654	274	1582	1552
Pandamangalam	67	33	100	26	38	95
Vennathur	88	12	364	111	475	582

ANNEXURE 3.11

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable population (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)
Achchundanvayal	578	1,476	1,469	2,945	1,301	-	1,301	681	54	26	46
Chitoor	734	871	789	1,660	1,202	-	1,202	467	35	22	31
Athyuthu	1,163	1,390	1,327	2,717	219		219	613	-	21	6
Chittrakottai	2,107	4,100	4,474	8,574	900	-	900	2,156	298	81	233
Ilamanoor	1,645	611	585	1,196	450	-	450	282	98	16	73
Madhavanur	1,354	872	823	1,695	553	-	553	416	41	36	40
Puthendal	1,144	1,094	1,105	2,199	835	-	835	507	76	39	65
Naranamangalam	1,597	895	869	1,764	505	-	505	420	71	36	61
Pullangudi	1,283	792	727	1,519	706	-	706	323	11	17	13
Peruvayal	1,236	699	711	1,410	1,155	-	1,155	370	94	20	72
Thoravallur	980	1,304	1,312	2,616	1,616	-	1,616	715	61	65	62
Surankottai	1,238	3,003	2,870	5,873	2,633	133	2,766	1,470	217	49	167
Kavanur	782	1,457	1,450	2,907	882	-	882	260	14	10	13
Karukudi	571	1,457	1,450	2,907	882	-	882	245	7	17	10
Thiruvolhiyakalugoorani	1,286	1,995	1,942	3,937	273	-	273	934	143	66	120
Madakottan	422	1,995	1,942	3,937	273	-	273	260	14	10	13
Paravoor	1,262	2,384	2,315	4,699	1,917	33	1,950	1,019	98	52	84
Kalanikudi	164	518	573	1,091	441	-	441	416	41	36	40
Devipattinam	1,386	5,531	5,315	10,846	1,604	-	1,604	2,678	141	68	119
Sakkarakottai	332	2,407	2,291	4,698	971	-	971	4,287	407	152	331
Therkutharavai	2,347	2,407	2,291	4,698	971	-	971	1,039	225	60	176
Karendal	713	675	638	1,313	438	-	438	314	9	17	11
Rajasuriyamadai	713	2,682	2,518	5,200	985	-	985	1,134	145	53	117
Pandamangalam	167	743	709	1,452	519	-	519	346	101	20	77
Vennathur	2,374	1,738	1,709	3,447	685	336	1,021	805	65	51	61

Gram Panchayat	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	Ground Water - Drinking source (No.)	Surface water - Drinking source (No.)	sum of drinking water sources (No.)
Achchundanvayal	7	534	443	17	-	1,220	5
Chitoor	7	673	444	57	350	630	3
Athyuthu	1	477	388	43	-	1,220	5
Chittrakottai	11	1,661	1,053	59	-	-	16
Ilamanoor	26	458	327	5	-	-	2
Madhavanur	9	759	591	73	300	-	3
Puthendal	13	558	476	34	250	-	4
Naranamangalam	14	507	387	67	300	-	3
Pullangudi	4	565	429	71	250	-	3
Peruvayal	19	372	271	56	-	-	3
Thoravallur	9	582	494	27	250	-	5
Surankottai	11	1,510	986	50	250	-	11
Kavanur	5	515	387	27	-	-	5
Karukudi	4	335	233	49	170	110	5
Thiruvolhiyakalugoorani	13	641	549	89	440	227	7
Madakottan	5	412	361	164	276	200	7
Paravoor	8	740	627	-	-	40	9
Kalanikudi	9	352	315	44	-	-	2
Devipattinam	4	826	652	199	2,300	600	20
Sakkarakottai	8	1,108	765	109	1,050	1,376	9
Therkutharavai	17	970	765	2,255	-	1,220	9
Karendal	4	408	322	40	300	150	2
Rajasuriyamadai	10	1,173	982	173	1,037	524	9
Pandamangalam	22	380	296	34	250	200	3
Vennathur	8	874	747	102	750	310	6

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

Gram Panchayat	Forest Land	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land
Achchundanvayal	14.70	32.22	195.19	4.38	-	0.02	1.10	8.13
Chitoor	1.89	51.21	60.56	16.28	0.99	0.37	27.05	4.64
Athyuthu	1.42	97.89	378.86	24.65	-	-	3.44	1.45
Chittrakottai	6.18	95.33	639.67	21.68	-	0.64	54.96	38.26
Ilamanoor	3.32	135.72	123.39	21.25	3.14	45.50	234.14	8.37
Madhavanur	20.96	47.69	176.29	51.99	8.51	15.97	19.33	56.20
Puthendal	2.52	36.99	-	-	-	-	39.30	84.49
Naranamangalam	4.27	84.24	378.91	29.84	5.28	4.23	57.79	39.98
Pullangudi	3.89	25.54	464.14	46.89	2.36	3.86	2.67	8.02
Peruvayal	7.74	72.38	237.18	47.46	8.40	9.27	14.19	68.72
Thoravallur	2.55	-	-	-	-	66.79	1.55	6.35
Surankottai	1.02	67.49	490.89	24.65	4.05	7.65	2.82	39.67
Kavanur	2.16	32.75	189.03	36.30	0.41	4.91	5.66	5.25
Karukudi	0.93	13.73	81.01	15.56	0.14	1.68	1.94	1.80
Thiruvolhiyakalugoorani	3.13	63.23	413.62	15.95	-	2.81	53.69	12.54
Madakottan	1.04	21.07	137.87	5.32	-	0.36	6.90	1.61
Paravoor	5.00	-	-	-	4.34	26.13	6.33	1.61
Kalanikudi	0.93	11.42	31.34	5.14	0.89	0.36	2.29	3.00
Devipattinam	7.55	92.41	253.61	41.61	3.20	1.29	8.23	10.80
Sakkarakottai	0.62	47.34	114.39	12.75	0.24	1.78	2.33	4.47
Therkutharavai	3.52	268.28	648.22	72.27	2.89	21.40	28.12	53.81
Karendal	74.44	23.14	16.87	11.91	-	3.22	3.20	6.44
Rajasuriyamadai	4.65	64.98	1270.41	27.37	-	-	46.42	29.23
Pandamangalam	24.84	-	5.51	-	-	3.23	6.40	6.10
Vennathur	30.72	127.79	604.88	68.26	-	6.26	8.27	37.46

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

Key CWRM Parameter	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Achchundanvayal	20	28	-
Chitoor	22	11	-
Athyuthu	33	57	-
Chittrakottai	38	94	-
Ilamanoor	36	21	-
Madhavanur	20	40	12
Puthendal	19	-	14
Naranamangalam	26	71	13
Pullangudi	24	89	2
Peruvayal	33	40	-
Thoravallur	6	-	9
Surankottai	22	90	6
Kavanur	13	32	-
Karukudi	5	14	-
Thiruvolhiyakalugoorani	14	61	-
Madakottan	5	20	-
Paravoor	13	-	-
Kalanikudi	8	5	-
Devipattinam	32	42	-
Sakkarakottai	16	22	1
Therkutharavai	63	102	-
Karendal	38	6	2
Rajasuriyamadai	36	225	9
Pandamangalam	15	1	2
Vennathur	66	118	6

ANNEXURE 5.3

GP WISE PROPOSED WORKS BASED ON WATERSHED AND LIVELIHOOD APPROACH (AREA IN ha / LENGTH IN m / PLANTS IN No.)

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	Plants	Area	No.	Length	No.
Achchundanvayal	37,531	47	4	428	1,712	4	1,59,650	200	1,419	5,676	4
Athyuthu	79,443	99	-	1,120	4,478	2	3,22,810	404	-	-	2
Chitoor	42,478	53	3	872	3,487	7	61,472	77	86	343	7
Chittrakottai	81,209	102	113	714	2,856	12	5,29,074	661	-	-	12
Devipattinam	79,963	100	13	444	1,775	7	2,36,174	295	271	1,083	7
Ilamanoor	1,11,231	139	-	213	853	3	1,15,716	145	280	1,121	3
Kalanikudi	9,883	12	58	469	1,875	2	29,190	36	-	-	2
Karendal	78,060	98	86	771	3,085	2	23,025	29	-	-	2
Karukudi	11,724	15	-	445	1,780	3	77,253	97	-	-	3
Kavanur	27,935	35	42	1,269	5,074	6	1,80,256	225	-	-	6
Madakottan	17,691	22	-	912	3,648	6	1,14,553	143	1,419	5,676	6
Madhavanur	54,919	69	150	350	1,399	6	1,82,621	228	797	3,188	6
Naranamangalam	70,801	89	25	350	1,399	3	3,26,998	409	-	-	3
Pandamangalam	19,870	25	-	471	1,885	3	4,406	6	128	510	3
Paravoor	4,002	5	-	491	1,964	9	-	-	-	-	9
Peruvayal	64,096	80	19	1,993	7,971	3	2,27,712	285	-	-	3
Pullangudi	23,550	29	4	350	1,399	7	4,08,823	511	828	3,313	7
Puthendal	31,613	40	17	350	1,399	4	-	-	-	-	4
Rajasuriyamadai	55,707	70	6	1,400	5,599	16	10,38,224	1,298	-	-	16
Sakkarakottai	9,966	48	44	448	1,793	11	25,429	127	-	-	11
Surankottai	54,804	69	6	350	1,399	17	4,12,434	516	983	3,933	17
Therkutharavai	2,17,441	272	10	2,346	9,383	23	5,76,394	720	-	-	23
Thiruvolhiyakalugoorani	53,086	66	39	1,963	7,852	17	3,43,655	430	-	-	17
Thoruvalur	2,037	3	28	350	1,399	9	-	-	-	-	9
Vennathur	50,130	159	-	1,449	5,797	9	1,34,626	673	368	1,470	9

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI		FD
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area	No.
Achchundanvayal	4	-	9	-	9,383	47	-	-	2	5	4	9	4
Athyuthu	2	1	5	1	19,861	99	-	-	1	2	2	5	2
Chitoor	7	11	33	11	10,620	53	384	1,535	7	17	13	33	7
Chittrakottai	12	22	94	22	20,302	102	2,097	8,387	19	47	38	94	12
Devipattinam	7	5	24	5	19,991	100	455	1,820	5	12	9	24	7
Ilamanoor	3	113	291	113	27,808	139	2,221	8,885	58	146	116	291	3
Kalanikudi	2	1	7	1	2,471	12	-	-	1	3	3	7	2
Karendal	2	3	13	3	19,515	98	759	3,036	3	6	5	13	2
Karukudi	3	2	6	2	2,931	15	-	-	1	3	2	6	3
Kavanur	6	4	16	4	6,984	35	2,006	8,023	3	8	6	16	6
Madakottan	6	3	9	3	4,423	22	230	921	2	4	4	9	6
Madhavanur	6	18	100	18	13,730	69	763	3,052	20	50	40	100	6
Naranamangalam	3	27	107	27	17,700	89	-	-	21	54	43	107	3
Pandamangalam	3	4	16	4	4,968	25	289	1,154	3	8	6	16	3
Paravoor	9	15	38	15	1,001	5	-	-	8	19	15	38	9
Peruvayal	3	13	101	13	16,024	80	1,671	6,683	20	50	40	101	3
Pullangudi	7	4	17	3	5,887	29	-	-	3	8	7	17	7
Puthendal	4	16	124	16	7,903	40	-	-	25	62	50	124	4
Rajasuriyamadai	16	19	76	19	13,927	70	1,878	7,510	15	38	30	76	16
Sakkarakottai	11	7	9	2	9,593	48	-	-	2	4	4	9	11
Surankottai	17	6	54	4	13,701	69	756	3,025	11	27	22	54	17
Therkutharavai	23	21	106	21	54,360	272	367	1,467	21	53	42	106	23
Thiruvolhiyakalugoorani	17	23	69	23	13,272	66	2,048	8,193	14	35	28	69	17
Thoruvalur	9	27	75	27	509	3	-	-	15	37	30	75	9
Vennathur	9	6	52	6	31,701	159	4,180	16,718	10	26	21	52	9

Gram Panchayat	GSS	ICP		LDI		LP		MI		NADEP	ND		PS
	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.	Plants	HHs	No.
Achchundanvayal	74	269	1,075	-	1	310	1,239	3	8	4	3,605	721	14
Athyuthu	44	374	1,497	1	2	779	3,116	1	1	2	2,940	588	6
Chitoor	88	264	1,054	6	14	360	1,438	2	5	7	2,205	441	9
Chittrakottai	209	145	579	11	28	760	3,040	15	38	12	10,370	2,074	30
Devipattinam	145	-	-	3	6	341	1,365	4	11	7	11,765	2,353	6
Ilamanoor	21	500	2,000	57	141	627	2,506	3	8	3	1,400	280	5
Kalanikudi	42	643	2,572	1	2	333	1,330	1	3	2	1,330	266	20
Karendal	2	134	534	1	3	323	1,290	3	6	2	1,565	313	1
Karukudi	10	60	241	1	2	56	225	1	2	3	3,830	766	4
Kavanur	24	147	587	2	5	173	693	2	5	6	3,830	766	9
Madakottan	22	269	1,075	1	4	25	102	1	2	6	4,760	952	8
Madhavanur	112	1,566	6,265	9	22	60	240	22	56	6	2,135	427	35
Naranamangalam	40	-	-	13	34	251	1,005	16	40	3	2,135	427	15
Pandamangalam	-	341	1,362	2	5	541	2,165	2	6	3	1,700	340	-
Paravoor	27	179	717	7	18	335	1,340	1	2	9	5,555	1,111	13
Peruvayal	53	654	2,616	6	16	520	2,080	27	69	3	1,815	363	8
Pullangudi	81	767	3,069	2	4	245	980	3	8	7	1,840	368	14
Puthendal	61	-	-	8	20	115	462	34	84	4	2,650	530	30
Rajasuriyamadai	17	636	2,543	9	23	666	2,663	12	29	16	6,355	1,271	8
Sakkarakottai	75	-	-	7	2	179	717	2	4	11	5,800	1,160	26
Surankottai	81	250	1,000	3	7	121	486	16	40	17	7,265	1,453	43
Therkutharavai	404	77	308	10	26	363	1,450	22	54	23	5,800	1,160	90
Thiruvolhiyakalugoorani	64	-	-	11	28	2,138	8,551	5	13	17	4,760	952	23
Thoruvalur	37	-	-	14	34	101	402	3	6	9	3,535	707	9
Vennathur	-	111	445	3	7	598	2,390	15	37	9	4,075	815	-

Gram Panchayat	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	No.	No.	No.	No.	No.	Area	No.	No.	Length
Achchundanvayal	2	6	-	2	-	-	7	72	1,075
Athyuthu	3	25	-	2	-	-	6	59	1,497
Chitoor	4	5	-	2	-	-	4	44	1,054
Chittrakottai	2	28	-	2	-	-	21	207	579
Devipattinam	3	13	-	2			24	235	-
Ilamanoor	6	5	-	2	-	-	3	28	2,000
Kalanikudi	1	3		2			3	27	2,572
Karendal	2	7	-	2	-	-	3	31	534
Karukudi	1	3		2			8	77	241
Kavanur	1	4		2			8	77	587
Madakottan		8		2			10	95	1,075
Madhavanur	-	9	-	2	-	-	4	43	6,265
Naranamangalam	-	13	-	2	-	-	4	43	-
Pandamangalam	7	6	-	2	-	-	3	34	1,362
Paravoor	2	9	-	2	-	-	11	111	717
Peruvayal	3	5	-	2	-	-	4	36	2,616
Pullangudi	1	8	-	2	-	-	4	37	3,069
Puthendal	1	2	-	2	-	-	5	53	-
Rajasuriyamadai	2	13	-	2	-	-	13	127	2,543
Sakkarakottai	1	3		2			12	116	-
Surankottai	2	6	-	2	-	-	15	145	1,000
Therkutharavai	1	14		2			12	116	308
Thiruvolhiyakalugoorani		11		2			10	95	-
Thoruvalur	1	6		2			7	71	-
Vennathur	7	20	-	2	-	-	8	82	445

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

Sl. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 21-02-2022 FY-2021-22 as on 02/02/2022
1	Achundanvayal	1,433	-
2	Athiyuthu	2,506	299
3	Chitharkottai	3,785	-
4	Chithoor	1,274	-
5	Devipattinam	4,658	-
6	Ilamanoor	1,272	-
7	Kalanikudi	632	10
8	Kalugoorani	1,939	28
9	Karendhal	601	-
10	Karugudi	1,019	187
11	Kavanoor	1,494	59
12	Madakkottan	2,337	-
13	Madavanoor	2,262	244
14	Naranamangalam	1,538	136
15	Pandamangalam	941	93
16	Peravoor	3,303	154
17	Peruvayal	1,479	256
18	Pullangudi	995	271
19	Puthendhal	1,482	137
20	Rajasooriyamadai	3,917	-
21	Sakkarakkottai	7,941	-
22	Surankottai	6,068	-
23	Therkutharavai	4,872	-
24	Thoruvaloor	1,980	-
25	Vennathoor	2,076	453

ANNEXURE 7.2

GP WISE ONGOING WORKS IN RAMANATHAPURAM BLOCK

GP	Work Category	Ongoing works
Achchudanvayal	Water Conservation and Water Harvesting	2
Atiyuthu	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Chithoor	Water Conservation and Water Harvesting	2
Chittrakkottai	Water Conservation and Water Harvesting	1
Devipattinam A/B	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Iilamanur	Water Conservation and Water Harvesting	2
Kalanikudi	Water Conservation and Water Harvesting	1
Kalugoorani	Water Conservation and Water Harvesting	2
Karendal	Drought Proofing	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	6
Karugudi	Water Conservation and Water Harvesting	1
Kavanur	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Madakkottan	Water Conservation and Water Harvesting	1
Madavanur	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Naranamangalam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Pandamangalam	Water Conservation and Water Harvesting	1
Peravur	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Peruvayal	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Pullangudi	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	5
Puthendhal	Water Conservation and Water Harvesting	1
Rajasooriyamadai	Water Conservation and Water Harvesting	2
Sakkarakkottai	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Surankottai A/B	Water Conservation and Water Harvesting	2
Therkutharavai	Water Conservation and Water Harvesting	1
Thoruvalur	Anganwadi/Other Rural Infrastructure	1
	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Vennathur	Rural Connectivity	1
	Rural Sanitation	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2

ANNEXURE 8

CWRM KEY INDICATORS FOR GPs IN THERKKU PERUVAYAL MICRO-WATERSHED

CWRM Parameter	Peruvayal
Soil Resources: Status of Available Nitrogen (%)	
Very Low	95.93
Low	3.25
Very High	0.81
Status of Organic Carbon (%)	
Very Low	47.97
Low	51.22
Medium	0.81
Status of Soil Micro Nutrients (%)	
Sufficient	75.00
Deficient	25.00
Status of Physical condition of the soil (%)	
Moderately Alkaline	100.00
Soil Texture (%)	
Fine Soil	72.57
Coarse loamy	1.46
Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	17.00
Estimated Soil Moisture (ha.m)	161.40
ET Losses (ha.m)	373.44
Means of Water Extraction (%)	
Gravity	29.00
Lifting	71.00
Irrigation Methods (%)	
Wild Flooding	87.00
Control Flooding	13.00
Livestock (No.)	
Cattle Population	137
Sheep Population	34
Goat Population	517
Poultry	323
Land Resources (ha)	
Non-Agricultural Uses	286.42
Barren & Un-cultivable Land	85.15
Permanent Pastures and Other Grazing Land	0.00
Land Under Miscellaneous Tree Criticalops etc.	279.03
Cultivable Waste Land	55.84
Fallows Land other than Current Fallows	44.21
Current Fallow land	48.80
Unirrigated Land	74.66
Area Irrigated by Source	361.71

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