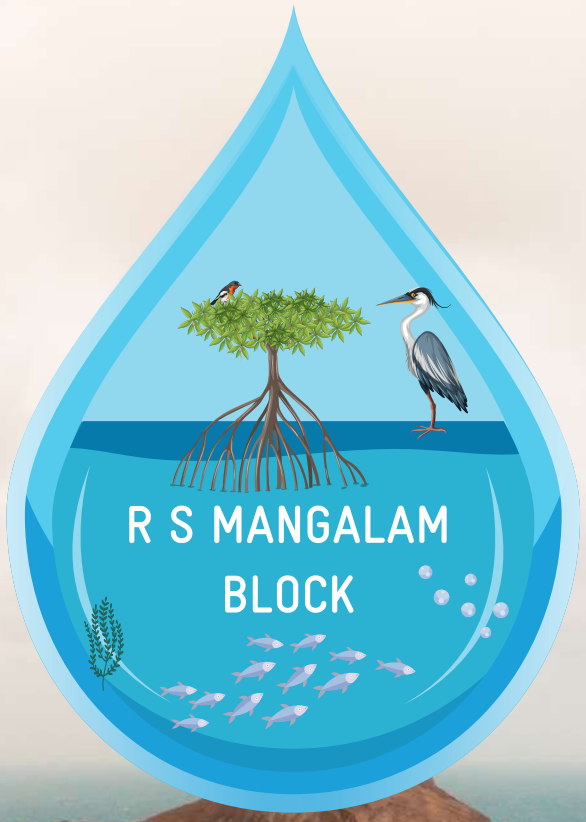
Ministry of Rural Development Ministry of Jal Shakthi

WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



SUSTAINABLE DEVELOPMENT GOALS

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

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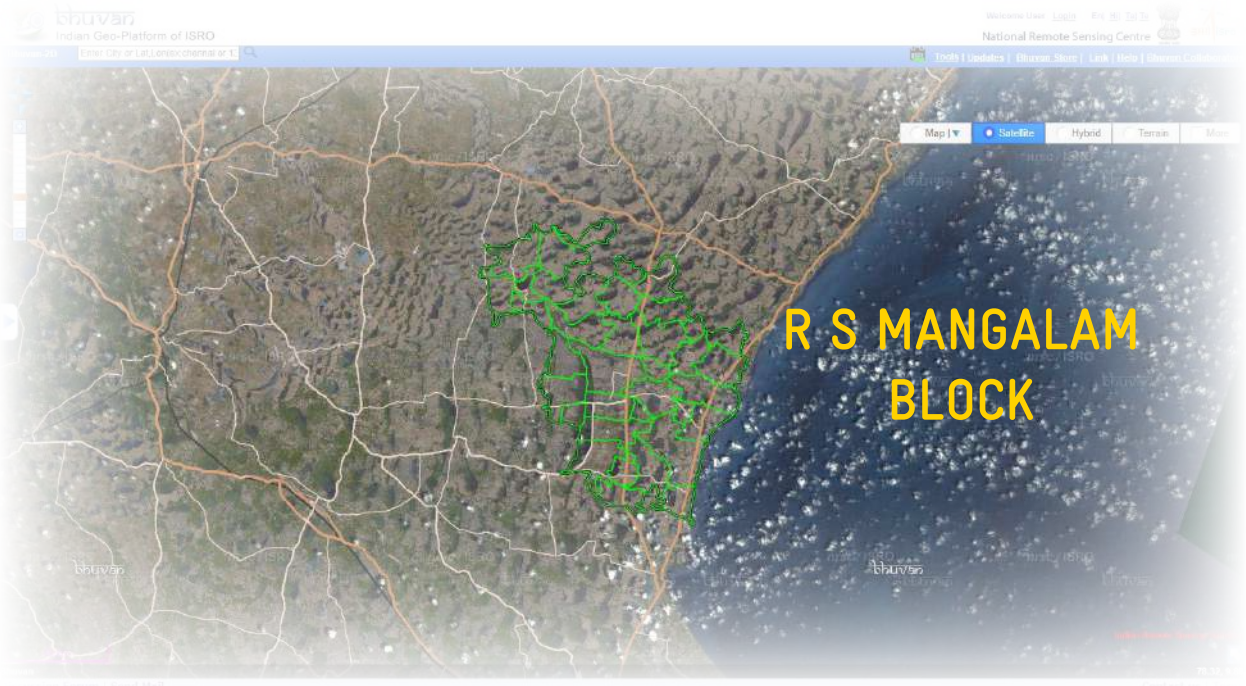
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

FOREWORD

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

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

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

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

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

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

This approach helped to complete 1,289 GP level plans in holistic way for a period of three years. Close to 10 lakh NRM and Non- NRM works are identified, verified, approved by Gram Panchyat. Out of the shelf

of projects, in the year 2021-22 FY, 2,80,000 works are uploaded in NREGA soft GIS planning portal. This is one of the largest number of works uploaded by any district or state for the current financial year.

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

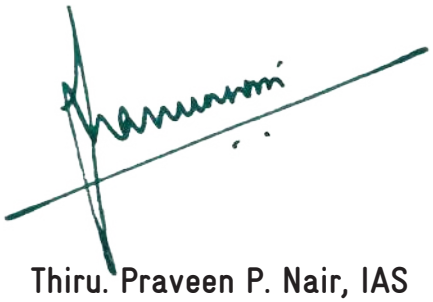
1.	Development of Public and Common lands
2.	Development of Agriculture and allied activities
3.	Development of Rural Infrastructure Management
4.	Development of Climate Resilience Measures

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

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

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

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



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

FOREWORD

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

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

> **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

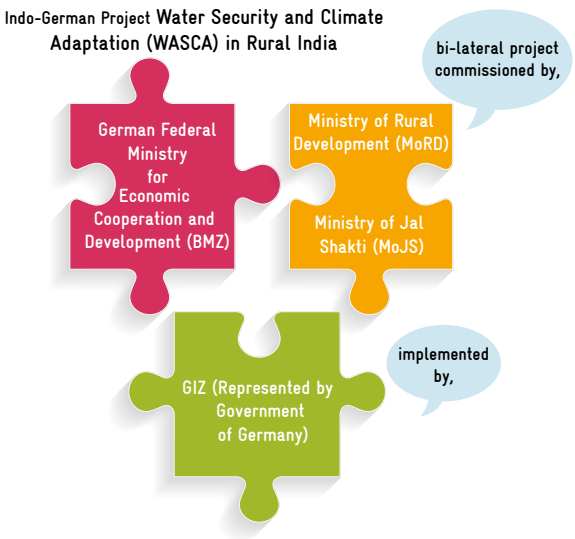
Thirukkural - 11

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

R S Mangalam, also known as Raja Singa Mangalam is one of the coastal Blocks of Ramanathapuram District. It is situated 35 kilometers north from the District headquarters Ramanathapuram and 11 kilometers from the Bay of Bengal. R S Mangalam lies between 9°31'42.177"N to 9°47'50.998"N latitude and 78°43'7.522"E to 78°58'9.528"E longitude. This Block has long coastal stretch in the east side along the Bay of Bengal and surrounded by Tiruvadanai, Nainarkoil, and Ramanathapuram Blocks (Figure 1.1). The total geographical area of Block is 38,832 ha (388.32 Km^2). Administratively, this Block comes under R S Mangalam taluk, and it has 35 Gram Panchayats with 325 hamlets.

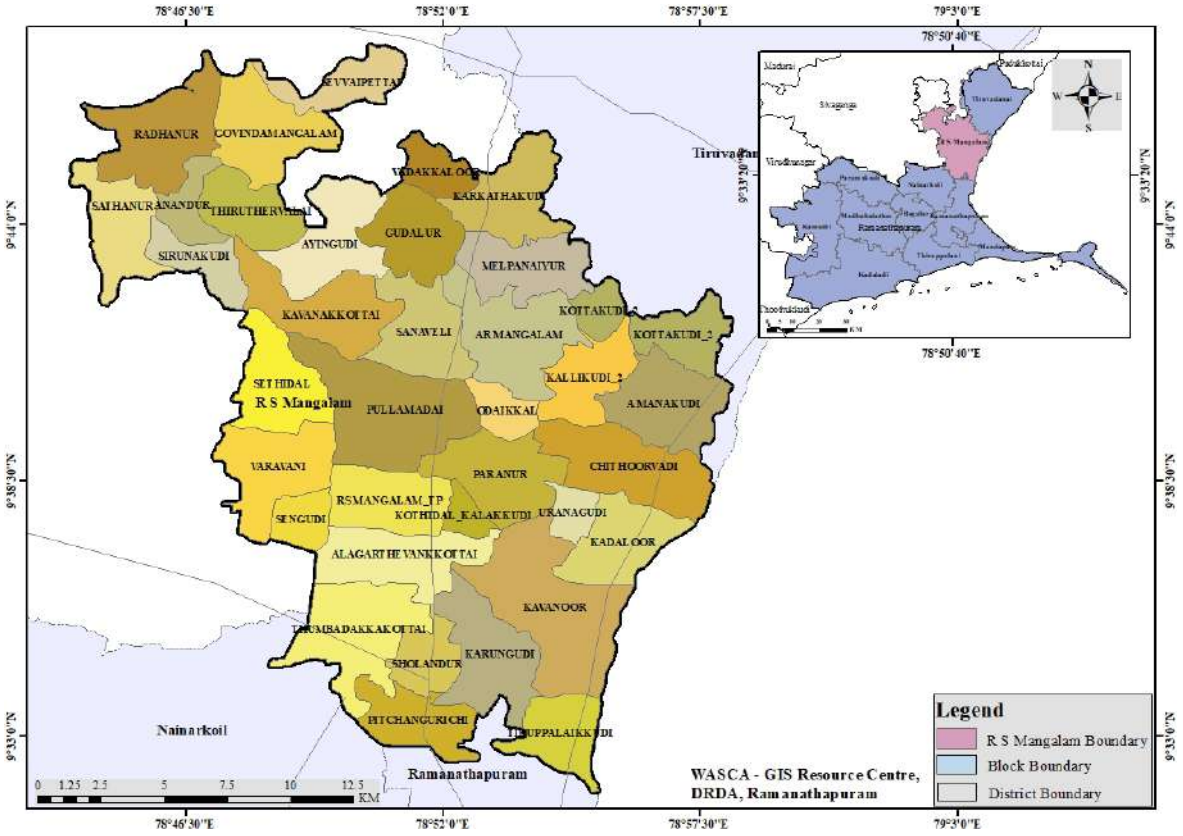


Figure 1.1. R S Mangalam Block and it's environ

According to Census 2011, the population of the Block is 84,742 The population density of the Block is 226 per Km^2 which is much lower than the district (331Km2) and the State's density (555 Km^2). The population growth has increased in the last decade with an increase of 10.70% in population, observed since 2001. The proportion of sex ratio is 1018 females for 1000 males. The average literacy rate of this Block is 77.96 % which is higher than the national average (72.98%). The male literacy rate is high (86.44%) than female literacy rate (69.68%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 22.91 % of the total population. Economically, this coastal rural Block is one of the backward Block. According to the State Planning Commission, Government of Tamil Nadu's Human Development Report – 2017, 41.67 % families are in below poverty line (BPL). The % of BPL families are high in this Block and higher than that of district BPL status. People of the Block are dependent on the coastal ecosystem, allied activities such as fishing, aquaculture etc,. Paddy is the dominant crop both under rainfed and irrigated conditions. Traces of Dry chilli, Sesemum, Ragi and Coconut cultivation is also seen. The Block has one milk society with 6840 lakh liters of milk being produced. R S Mangalam is known for its picturesque landscapes and a number of temples and other places of worship.

> 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%).

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

Hydrologically, R S Mangalam Block comes under Kottakkaraiyar sub-basin of Pambar Kottakkaraiyar basin. Kottakkaraiyar and Sarugani Rivers flow through the Block. Lower Vaigai and Kottakkaraiyar macro- watersheds covers the Block with 94 micro-watersheds (Figure 1.2). Situated in the rain shadow area, Ramanathapuram District has the extraordinary tank irrigation system which was built hundreds of years ago.

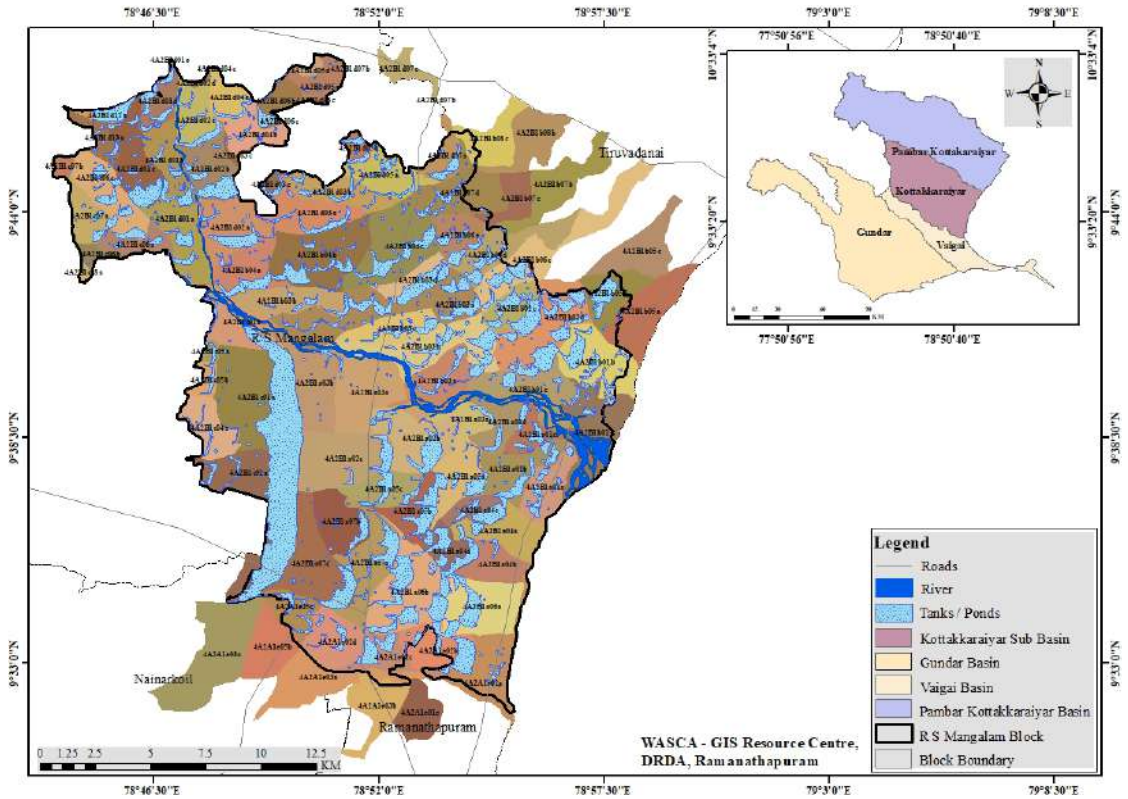


Figure 1.2. Watersheds – R S Mangalam Block

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 also useful for farmers who do not have water source for irrigation or find it expensive. There are 251 major and minor tanks in this Block, 68 Ex Zamin MI tanks, 106 Panchayat MI tanks and 77 PWD tanks (Human Development Report 2017). Figure 1.3 shows the spatial distribution of water bodies in this Block. Two firkas namely Sholandhur and R.S.Mangalam cover the Block, and both firkas are safe in ground water development (CGWB's ground water assessment report 2017).

GROUND WATER LEVEL OF THIS BLOCK

SAFE - <70%	Sholandhur, R.S.Mangalam

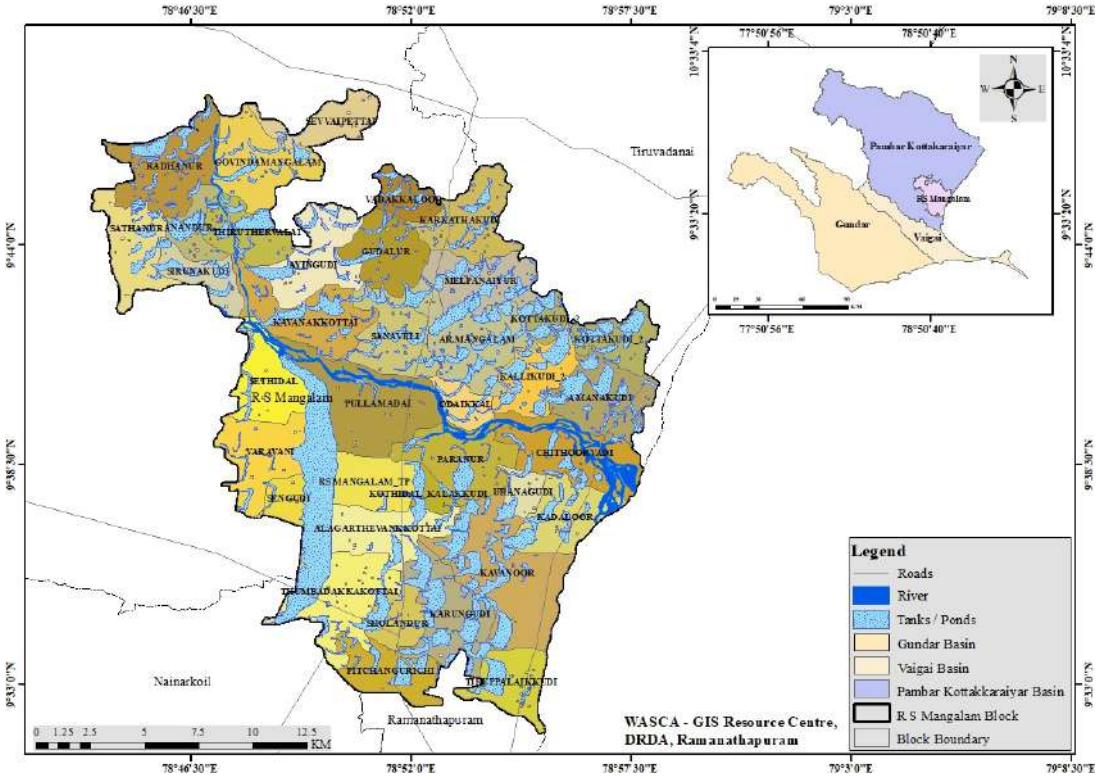
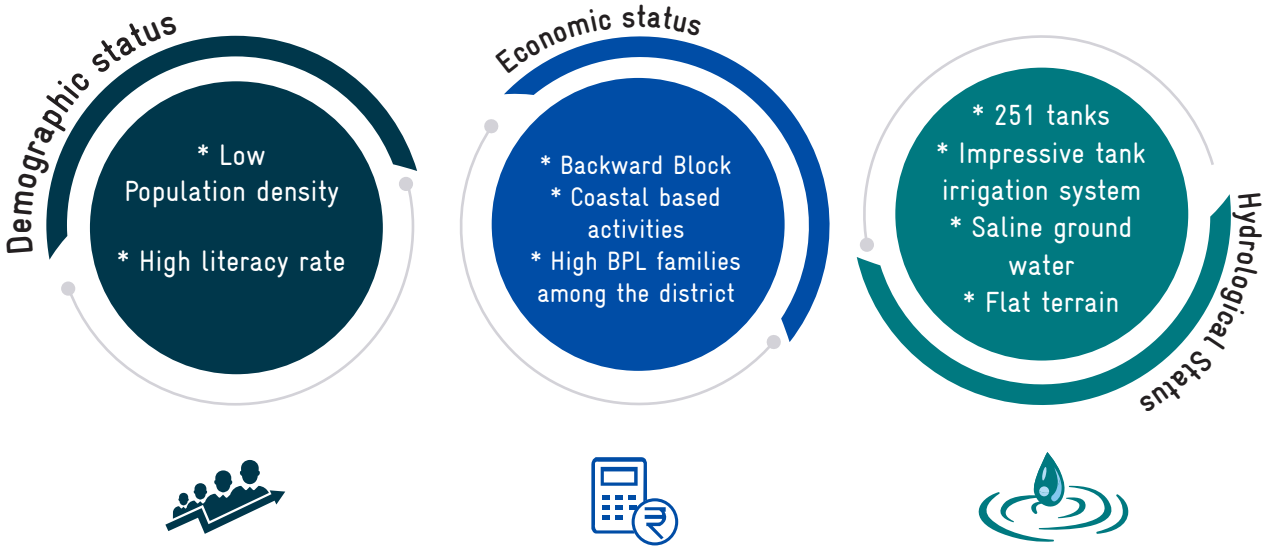


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

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

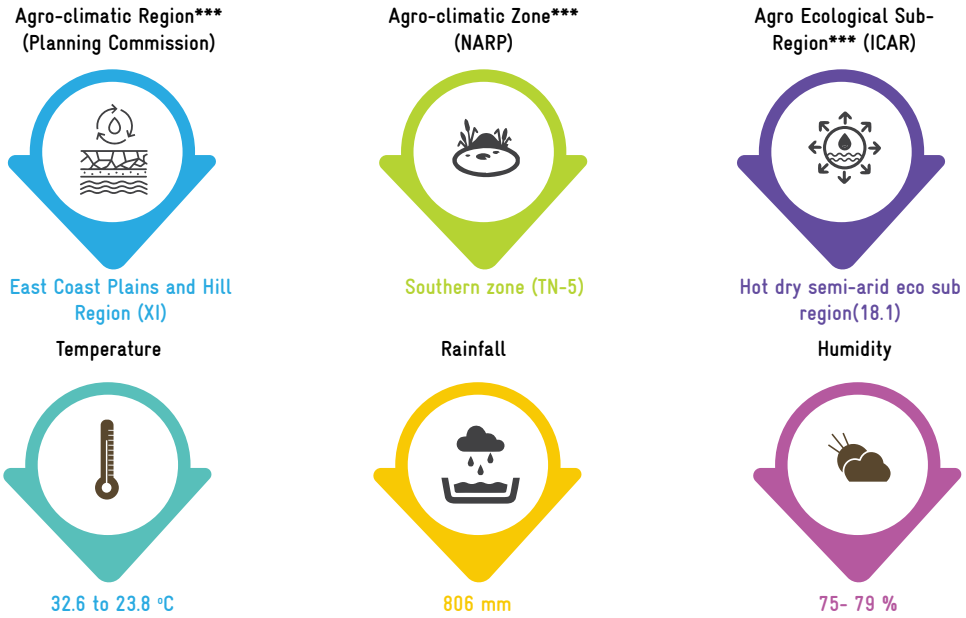
Thirukkural - 13

CHAPTER 2

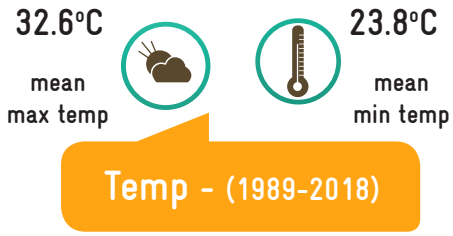
2 CLIMATE AND WATER SECURITY

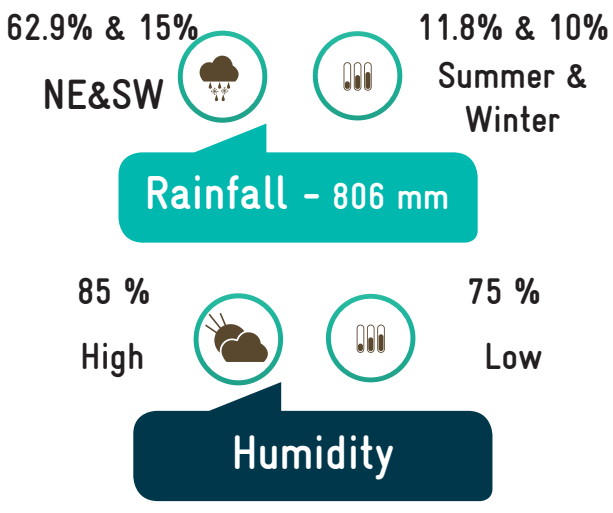
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of the Planning Commission. The general climate description of this region 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 during the last 30 years (1989-2018) (IMD). In summer months the maximum temperature goes up to 45°C 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 State's average rainfall. Normally this region receives major rainfall from North East Monsoon (NEM) (October to December) followed by South West Monsoons (SWM) (June to September), winter and summer months. NEM contribute a maximum of 62.9 % (507.4mm) of the total annual rainfall and SWM contributes 15% (121.7mm). This region normally receives 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 (WRIS, GoI) (Figure

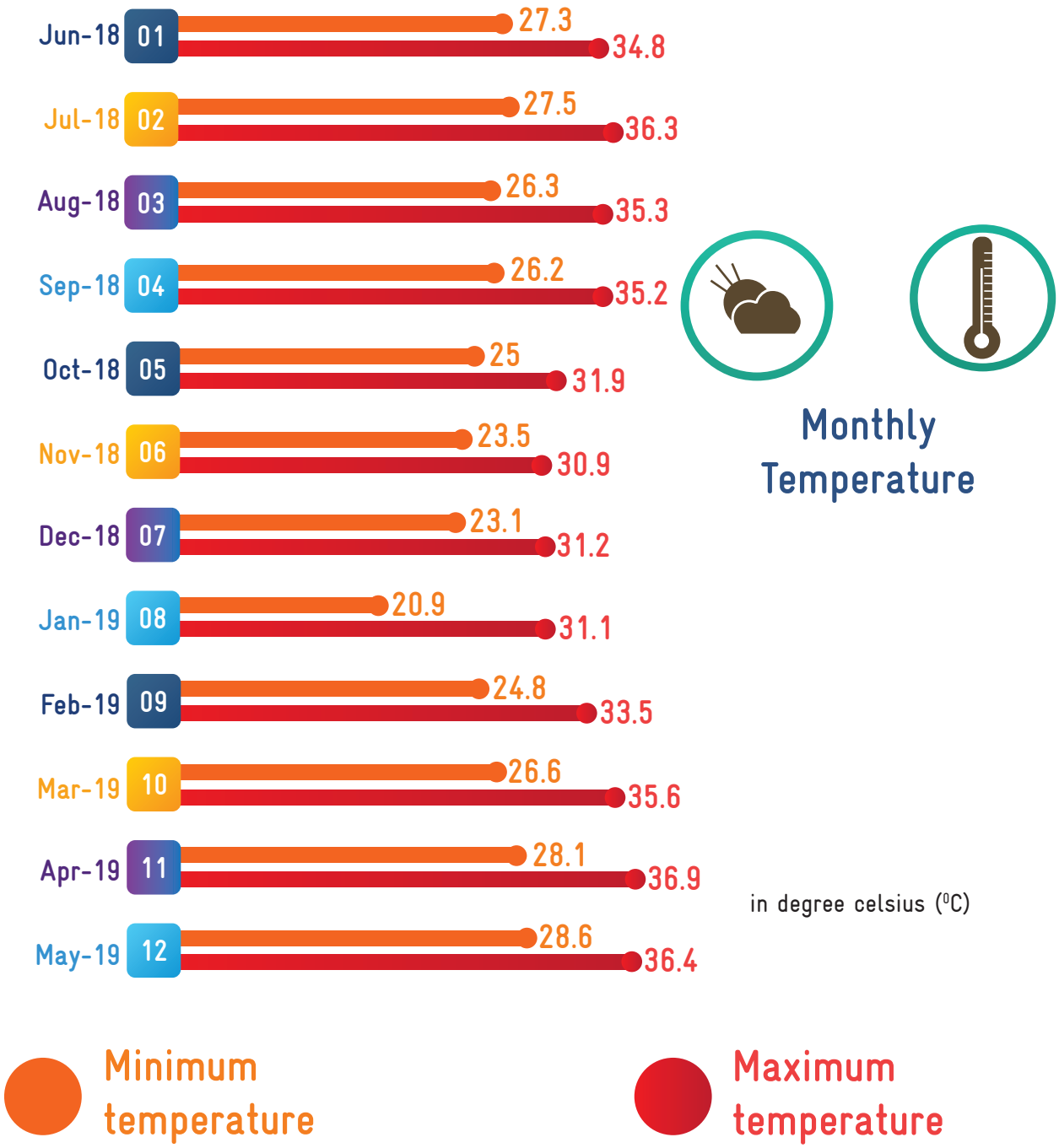


Figure 2.1. Monthly average maximum and minimum temperature

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

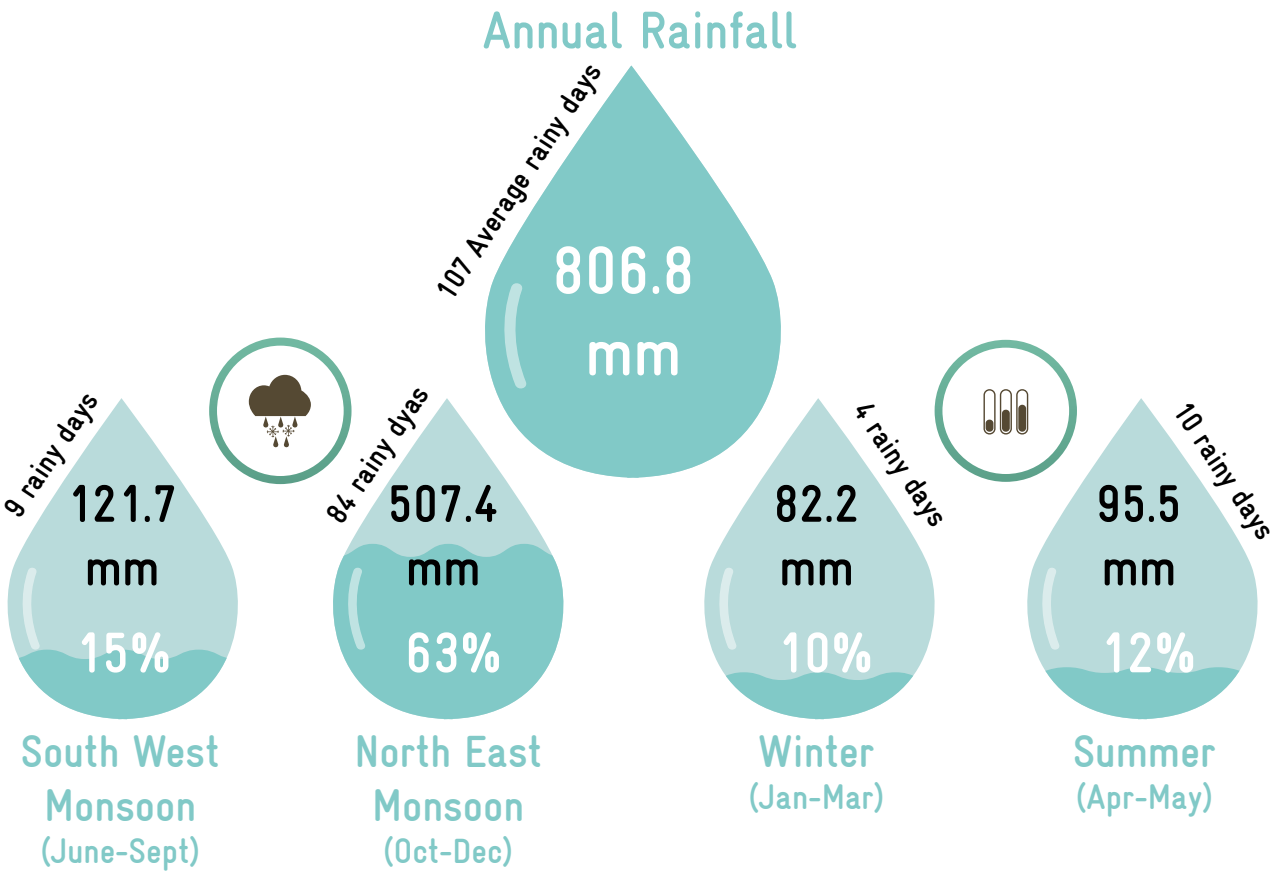


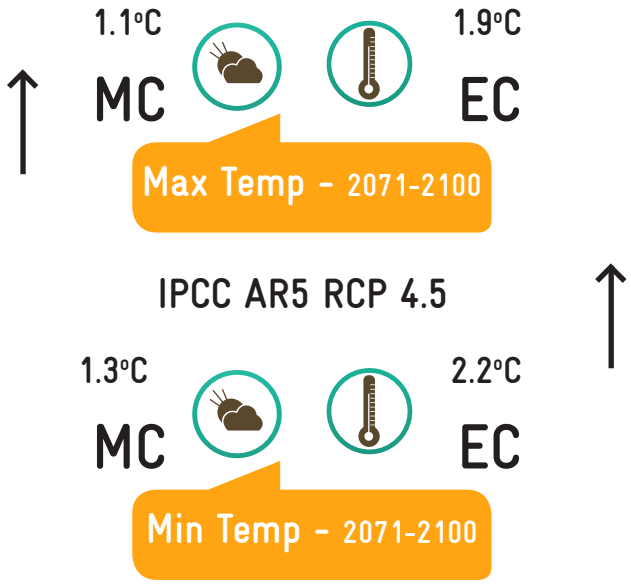
Figure 2.2. Season wise distribution to annual rainfall

In recent decades, the world has 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, 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 along with deficient rainfall years.

The continuous assessment reports of Intergovernmental Panel on Climate Change (IPCC) cautioned 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
* Sea level rise

Drought

Generally, this rain shadow region has a prolonged dry climate. Majority of the 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 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 (SDMA- Ramanathapuram District Disaster Management Plan 2020-2021). This Block has no flood vulnerable locations as per SDMA report 2020-2021.

Sea level rise

Sea level rise (SLR) is one of the greatest challenges of the low-lying coastal regions of the world. Recent Intergovernmental Panel on Climate Change (IPCC) 2021 report cautioned that there The average rate of SLR was 1.3mm/yr (1901-1971) and rose by 03.7mm yr (2006-2018), and it would continue to rise to 2 m by the end of the Century under a very high emissions scenario (SSP5-85 low confidence) (IPCC, 2021). IPCC cautions that coastal areas will get continued SLR throughout the 21st century, contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion. This coastal region will also face sea level rise and future SLR projection studies indicates there would be 4.51 cm (low range)/ 7.21cm (medium range) increases for the year 2025 and it would be 30.29 (low range), 49.10 cm (medium range) under IPCC AR5-RCP 4.5 scenario (CCCDM, Anna University). In Ramanathapuram District, about 180 coastal habitations are identified for coastal vulnerability based on their distance from sea shore, soil erosion, saltwater intrusion (Ramanathapuram District Disaster Management Plan 2021-2022). Out of these 180 habitations, 4 habitations in three GPs are in R S Mangalam 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

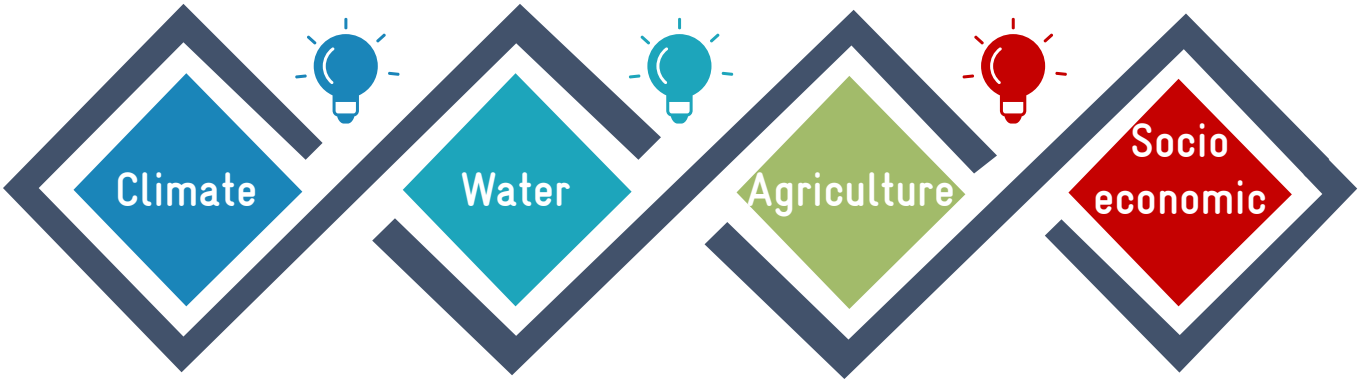
CWRM	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (^{O}C)	C1	Goal 13
	Changes in min temperature (^{O}C)	C2	
	Changes in rainfall (%)	C3	
	Excess rainfall years	C4	
	Deficient rainfall years	C5	
Water	Ground water extraction (%)	W1	Goal 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 the 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.

The special focus on vulnerable households and communities are considered while preparing estimates for anticipated demand, list of works on individual land, and list of other works that provide direct individual benefits. The Convergent Planning Exercise shall make use of automatically included and deprived Households of SECC to ensure full coverage of poor and vulnerable households. Infrastructure built under Mahatma Gandhi NREGS leads to increased water availability for irrigation, groundwater recharge, increased agricultural production, and carbon sequestration. The Ministry of Environment, Forest and Climate Change recognizes Mahatma Gandhi NREGA as one of the 24 key initiatives to address the problem of climate change, while simultaneously improving the livelihoods of the poor. Mahatma Gandhi NREGA, particularly 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.

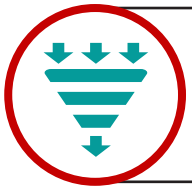
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182 Kinds of works relate to NRM alone

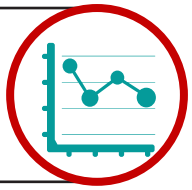
164 Kinds of works related to Agriculture & allied works

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 and 164 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 the 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.

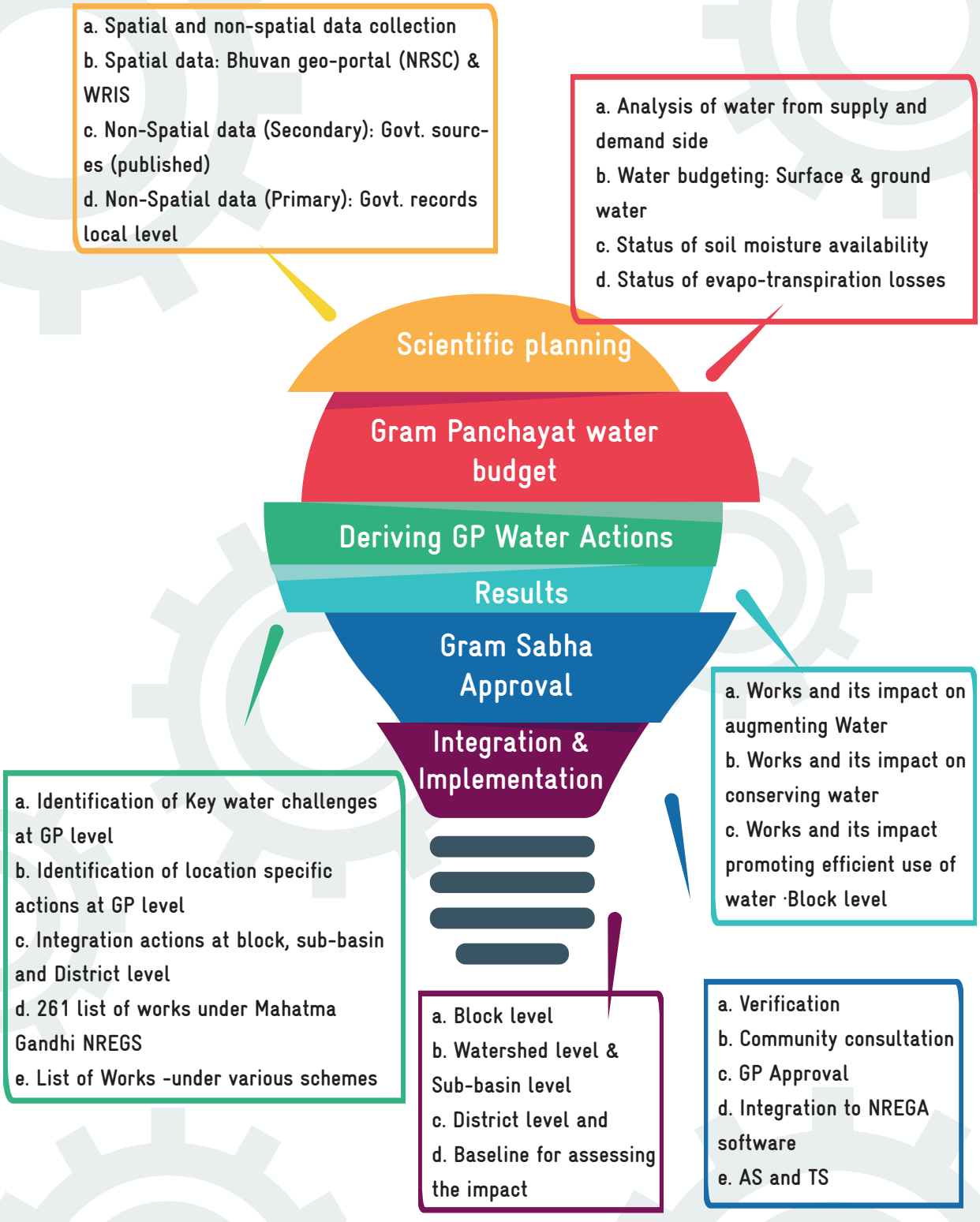


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

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).

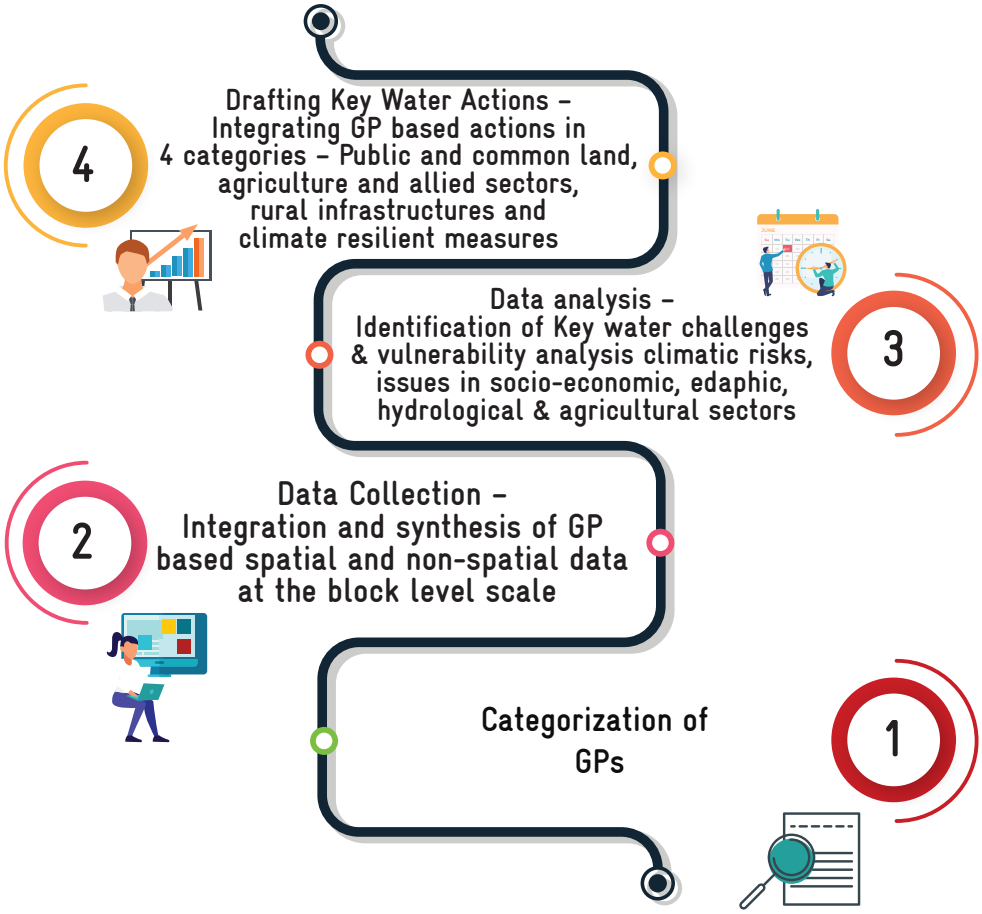
BOX 1. MAJOR COMPONENTS INVOLVE IN CWRM PLANNING WORKOUTS



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 measures as an adaptive measure to the emerging climate change scenarios. The water challenge linked water actions are the key in developing the perspective plan for the water secured GPs, serve as shelf of projects. This shelf of projects is again mapped with the 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

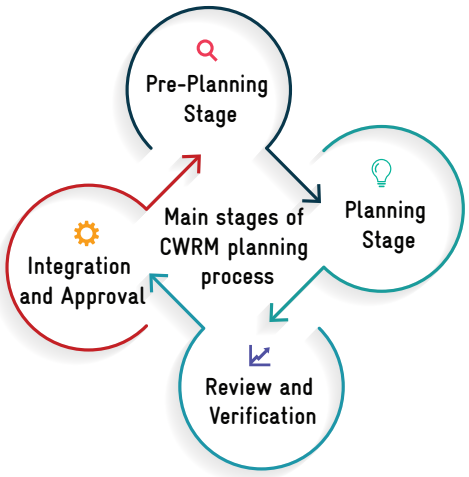
PLANNING STAGE

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 datasets. Based on the above factors, five different types of GPs are classified as Type I, II, III, IV and V. The description of categorization of GP's is given in Annexure 1. Details of categorization of GPs in R S Mangalam Block is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF R S MANGALAM BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
9	GP and revenue village data and boundary match (Type-I)	Radhanur, Tiruppalaikkudi, Chituruvadi, Alagarthevankottai, Karkathakudi, Thumbadakottai, Sethidal, Urangudi, Sholandur
6	Having more than one GPs in one Revenue Village (Type-II)	Senkudi, Varavani, Govindamangalam, Sevvaipettai, Anandur, Sirunagudi
2	One GP is falling under more than Type 1 one Revenue Village (Type III)	Pullamadai, Sattanur
18	GPs having more than one GP, one Revenue Villages data, boundary (Type-IV)	Arunuthimangalam, Odaikkal, Paranur, Thiruthervalai, Ayangudi, Gudalur, Vadakalur, Kadalur, Kavanoor, Kothaidal, Kallikudi, Kavanakottai, Sanavelli, Karungudi, Pitchanakurichi, Kottagudi, A.Manakudi, Melapanaiyur

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

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

3.4 CWRM PLANNING ANALYSIS – CLIMATE

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

TABLE 5. CLIMATE RISKS AND VULNERABLE GP's

LIST OF HABITATIONS AND GPs HAVE COASTAL VULNERABILITY

GP name	Habitations
Mullimunai	Morepannai
Thiruppalaikkudi	Thirupalaikudi North, Thirupalaikudi South
Kadalur	Uppur


List of habitations
and GPs have coastal vulnerability
Distance from sea shore (in meters)
1000
100
1500
40
30
30
Uppur
Morepannai
Thirupalaikudi North
Thirupalaikudi South
Habitations

3.5 CWRM PLANNING ANALYSIS – WATER

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

3.5.1 SPATIAL DATA

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

3.5.1.1 Geomorphology: Geomorphology deals with the scientific study of "landforms and landscapes, including their description, type, and genesis". Landform is the end product resulting from the interactions of the natural surface genesis and the type of rock. The scope of geomorphology was further expended with landform maps, which are widely used in various fields of hydrology, pedology, geoscience, urban and regional planning etc. R S Mangalam Block is engrossed with coastal origin landform units (Figure 3.1). Coastal 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 a critical input while identifying suitable sites for NRM activities under CWRM plan preparation.

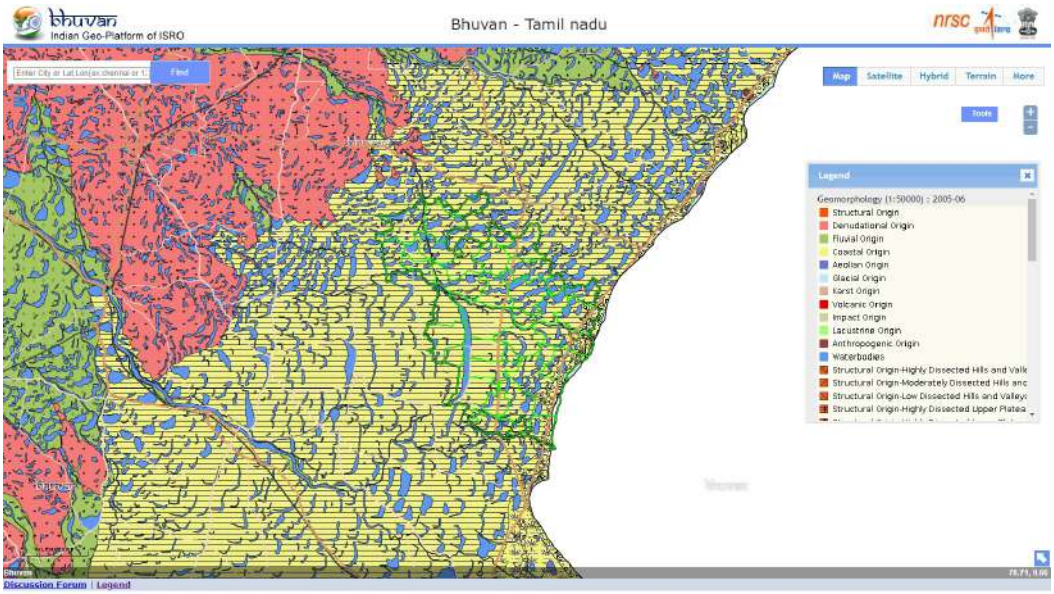


Figure 3.1. Geomorphology map

Origin	Area coverage in %	Gram Panchayat
Coastal Origin - Older Deltaic Plain		
	95%	Alagarthevankkottai, Anandur, Ayingudi, Govindamangalam, Gudalur, Kallikudi, Karkathakudi, Karungudi, Kavanakkottai, Kothidal_Kalakkudi, Kottakudi, Melpanaiyur, Odaikkal, Paranur, Pitchangurichi, Pullamadai, Radhanur, Sanaveli, Sathanur, Sengudi, Sethidal, Sevvaipetta, Sholandur, Sirunakudi, Thiruthervalai, Thumbadakkakottai, Uranagudi, Vadakkaloor, Varavani - 100%, Kottakudi - 90%, A Manakudi - 80%, Chithoorvadi - 75%, Tiruppalaikkudi - 70%, Kavanoor - 65%, Kadaloor - 60%
Coastal Origin - Younger coastal Plain		
	24%	Kavanoor - 35%, Chithoorvadi, Tiruppalaikkudi - 30%, Kadaloor - 25%, A Manakudi - 20%, Kottakudi - 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 or 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.

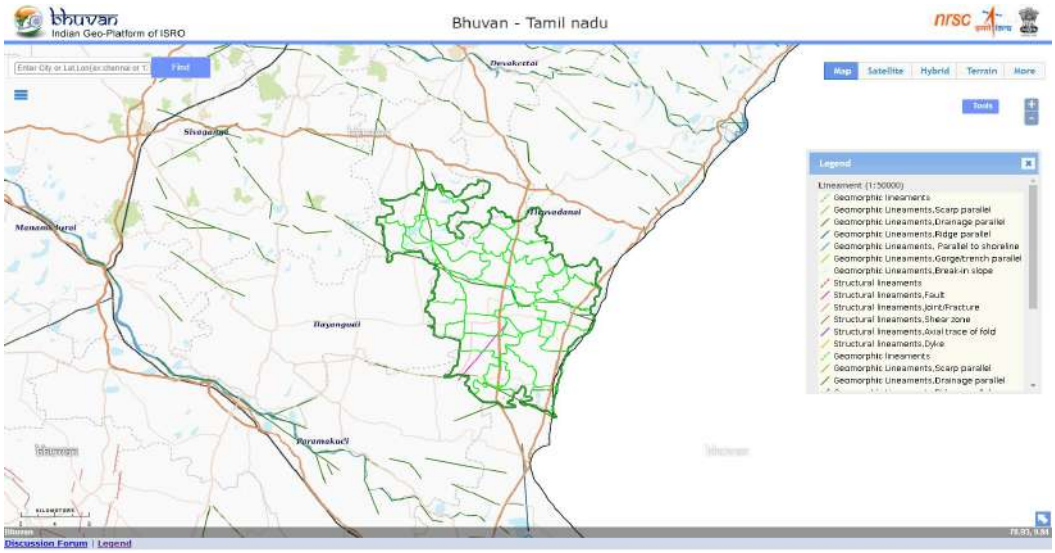


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Structural lineaments, Axial trace of fold	
	Alagarthevankkottai, Thumbadakkakottai
Geomorphic lineaments, Drainage parallel	
	Anandur, Govindamangalam, Kavanakkottai, Paranur, Pitchangurichi, Pullamadai Radhanur, Sathanur, Sethidal, Thiruthervalai, Tiruppalaikkudi

3.5.1.3 Terrain: The terrain map gives information related to elevation from above sea level. A terrain of the 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.

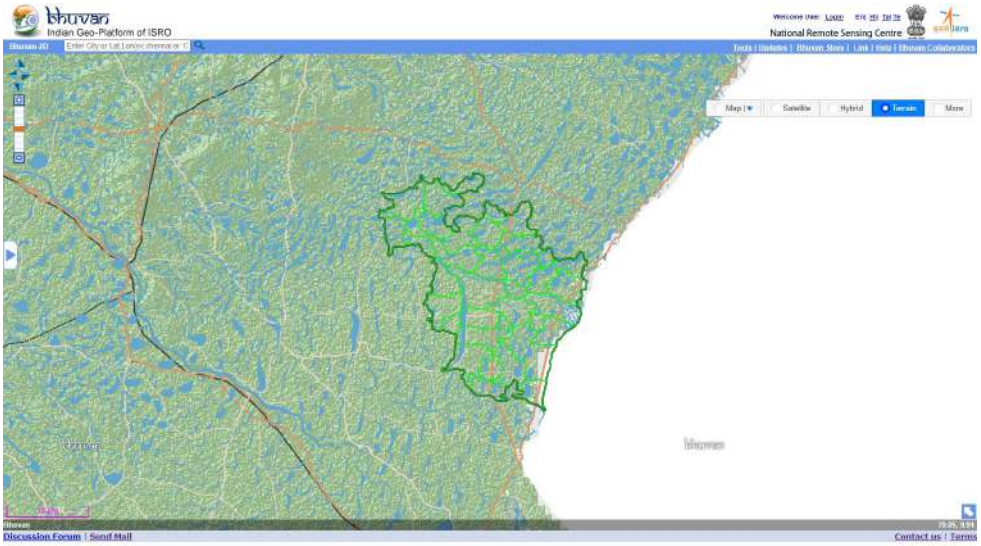


Figure 3.3. Terrain map

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

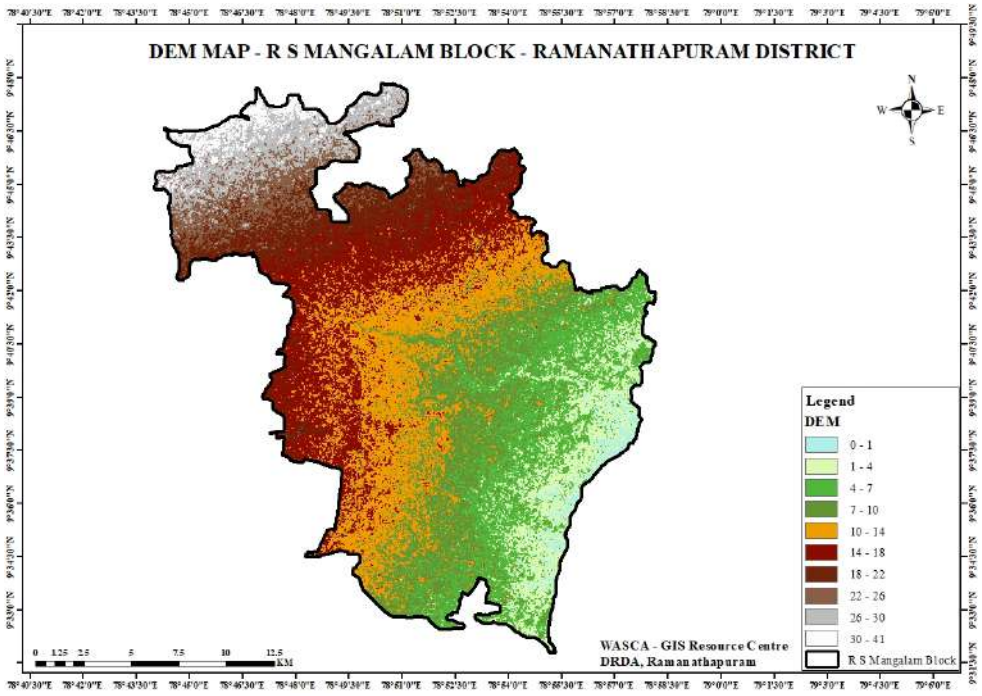


Figure 3.4. DEM map

3.5.1.5 Slope: The average slope of a terrain feature is calculated from contour lines on a topology map or DEM. Slope is typically expressed in percentage, angle, or in ratio. Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. 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.

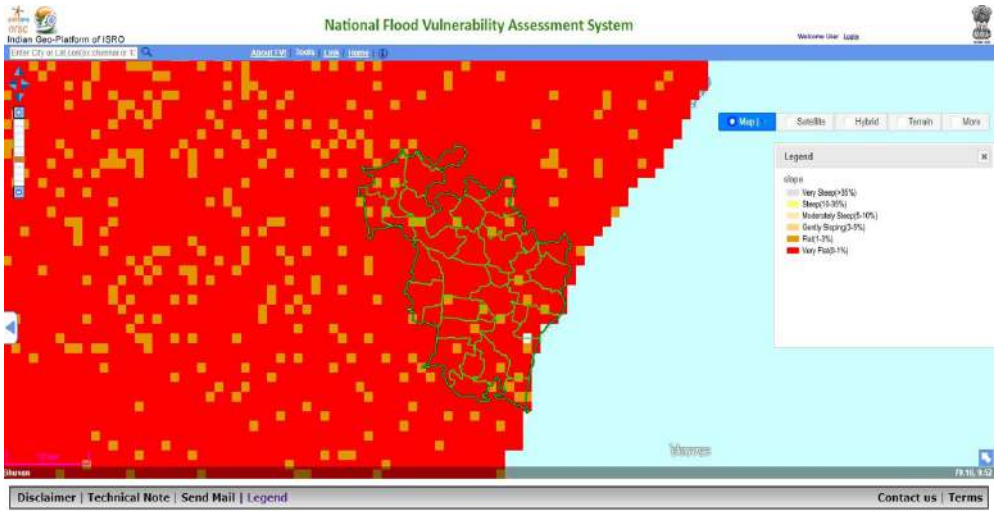


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Very Flat (0-1%)	94%	A Manakudi, Govindamangalam, Kallikudi, Kottakudi, Odaikkal, Paranur, Pitchangurichi, Pullamadai, Sanaveli, Sengudi, Sethidal, Sholandur, Thiruthervalai, Vadakkaloor, Varavani - 100%, Alagarthevankkottai, Anandur, Kadaloor, Karungudi, Thumbadakkakottai, Uranagudi - 95%, Ayingudi, Karkathakudi, Kavanakkottai, Kavanoor, Melpanaiyur - 90%, Chithoorvadi, Kothidal_Kalakkudi - 85%, Radhanur, Sathanur - 80%, Tiruppalaikkudi - 70%
Flat (1-3%)	11%	Tiruppalaikkudi - 30%, Radhanur, Sathanur - 20%, Chithoorvadi, Kothidal_Kalakkudi - 15%, Ayingudi, Karkathakudi, Kavanakkottai, Kavanoor, Melpanaiyur - 10%, Alagarthevankkottai, Anandur, Kadaloor, Karungudi, Thumbadakkakottai, Uranagudi - 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 measures such as dams, ponds, bunding, restoration of gullied region etc.

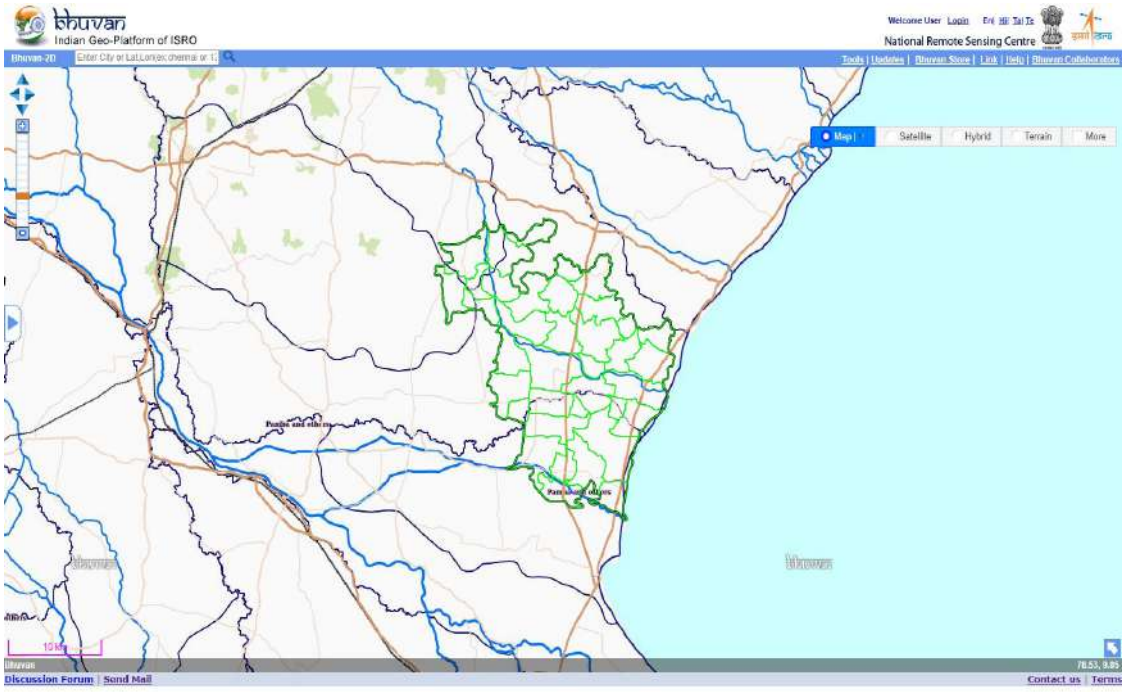


Figure 3.6. Drainage network

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. R S Mangalam Block watershed map is illustrated in Figure 3.7. Watershed is used for the interventions based on Ridge to Valley (R2V) concept and sequencing the plan accordingly. R2V approach intends to conserve each drop of rain water from ridge to a reasonable extent and it ensures the better surface water flow management also aids in strengthening the durability of land, soil and water conservation structures of the downstream.

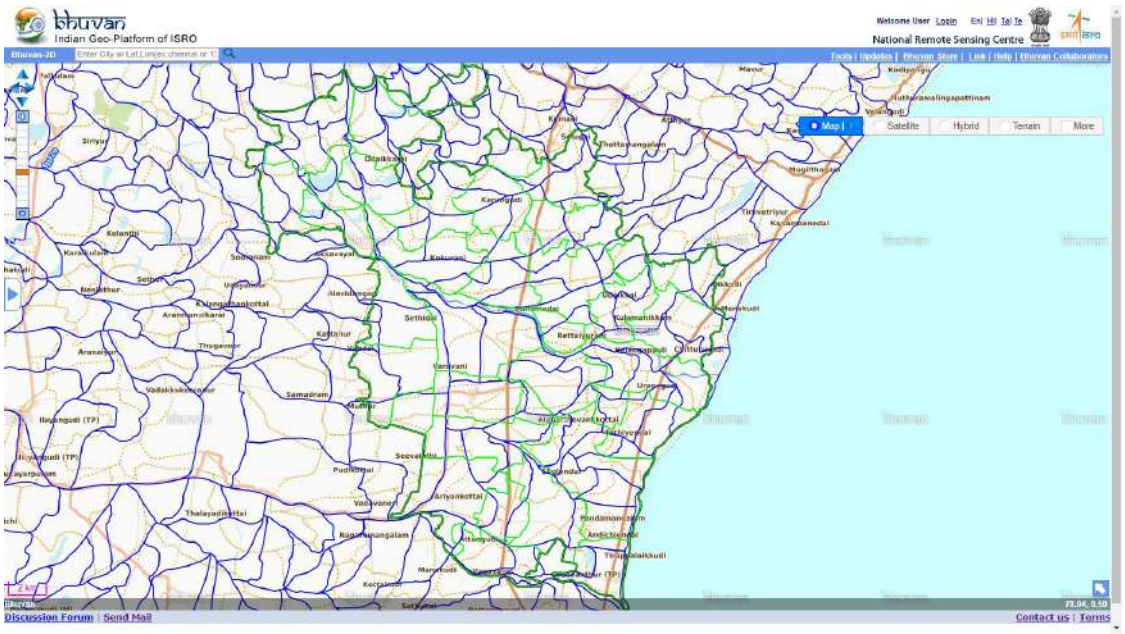


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water is one of the important natural resources in a semi-arid region like R S Mangalam Block. The ground water perspectives map is the integration of lithology, geomorphology, geological structures, hydro geomorphic datasets, which provides the required information related to ground water exploration and the probable ground water prospects. This map will help in identification of tentative locations for construction of recharge structures. In the Block area, ground water is available from 30 m. 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.

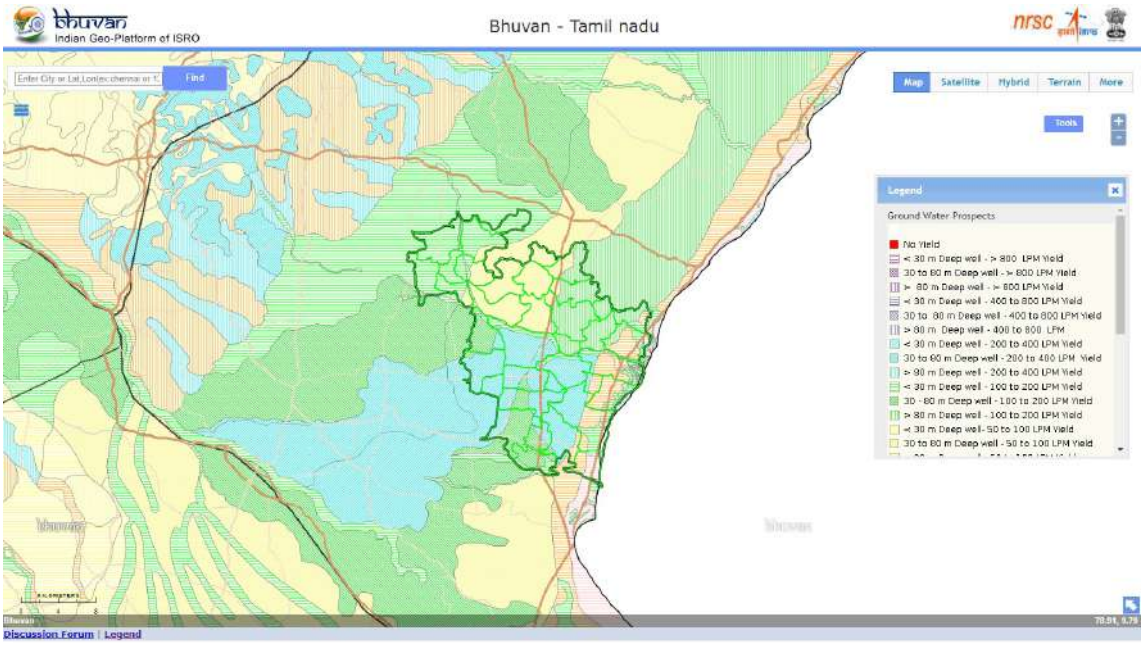


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat
<30m Deep well - 100 to 200 LPM Yield		
	79%	Anandur, Govindamangalam, Radhanur, Sathanur - 100%, Sirunakudi - 80%, Thiruthervalai - 40%, Kavanoor - 35%
30-80m Deep Well-100 to 200 LPM Yield		
	58%	Pitchangurichi - 85%, Sethidal - 80%, Sholandur - 75%, Thumbadakkakottai - 70%, Alagarthevankkottai - 30%, Karungudi - 5%
>80m Deepwell - 1000 to 200 LPM Yield		
	71%	Kallikudi, Kottakudi, Odaikkal - 100%, Melpanaiyur - 95%, Karkathakudi, Kottakudi - 50%, A Manakudi - 5%
30 to 80m Deep well -50 to 100 LPM Yield		
	61%	Ayingudi, Gudalur, Kavanakkottai, Vadakkaloor - 100%, Sanaveli - 85%, Thiruthervalai - 60%, Karkathakudi - 40%, Govindamangalam, Melpanaiyur, Sirunakudi - 10%
<30 m Deep well -200 to 400 LPM Yield		
	66%	Kothidal_Kalakkudi, Sengudi - 100%, Paranur, Varavani - 95%, Pullamadai - 90%, Karungudi - 80%, Alagarthevankkottai - 70%, Kavanoor - 45%, Sholandur - 40%, Thumbadakkakottai - 35%, Sethidal - 25%, Chithoorvadi - 15%
<30 m Deep well -30 to 50 LPM Yield		
	48%	Uranagudi - 80%, Chithoorvadi - 70%, A Manakudi, Kadaloor - 65%, Kavanoor - 45%, Tiruppalaikkudi - 30%, Karungudi - 25%, Kottakudi - 5%
<30 m Deep well -10 to 20 LPM Yield		
	60%	Tiruppalaikkudi

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)	23,267
Length of Minor Canal (m)	77,172
Length of Distributaries (m)	1,09,147
Water Courses (Field Channels) (m)	1,63,162
Traditional Water bodies (No.)	
Number of Tanks (PWD & Union)	212
Number of Ooranis	396
Other Surface Water Bodies	1
Irrigation Facilities (ha)	
Tank Irrigation	6,526.62
Canal Irrigation	504.50
Open & Tube Well Irrigation	1,546.87
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	1,393
Average Catchment Area	117.90
Bad Catchment Area	3,484.30
Watershed and Drainage Networks	
Length of Natural Drainage Lines (m)	41,471.51
Number of Natural Drainage Lines (No.)	46
Number of Micro-watersheds (No.)	211
Water Demand	
For Humans (ha.m)	231.75
For Livestock (ha.m)	48.31
For Agriculture (ha.m)	28,311.07
GW Utilization for Drinking (%)	89.66
GW Utilization for Livestock (%)	85.29
GW Utilization for Agriculture. (%)	13.66
SW Utilization for Drinking (%)	10.34
SW Utilization for Livestock (%)	14.71
SW Utilization for Agriculture (%)	86.34

3.5.2.1 Existing Water Structures

Waterbodies are the life lines of local communities for their lives and livelihoods. The Block has structured traditional water storage units such as tanks, ooranis and other surface waterbodies. It is noticed that the number of Ooranis are more (396) than other structures (Figure 3.9).

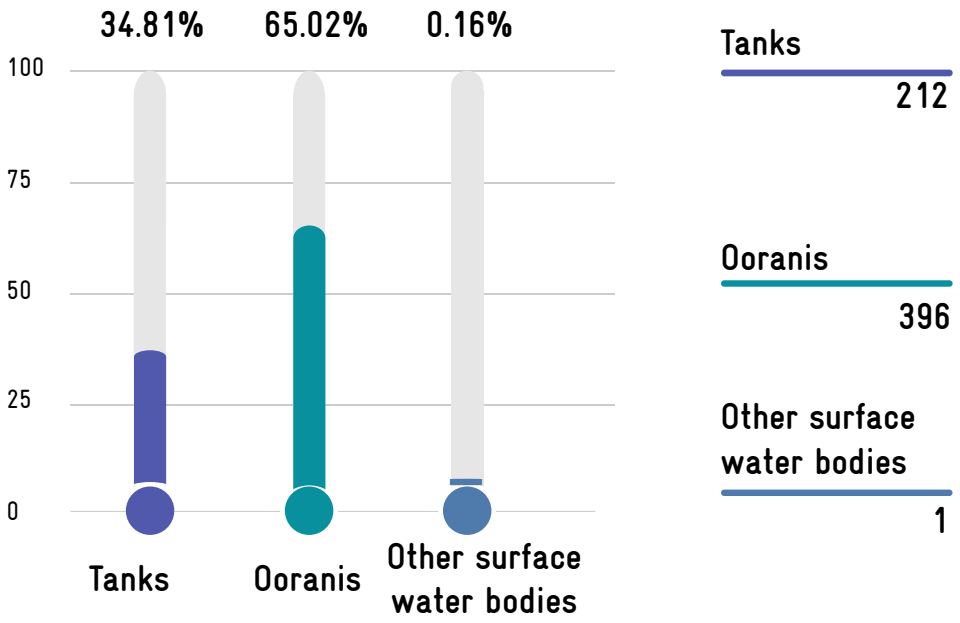


Figure 3.9. Traditional Waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 8,577.99 ha, of which 76 % (6,526.62) area is irrigated through tanks, followed by 18 % (1,546.87 ha) through open/tube well and the remaining 6 % (504.5 ha) area is through canal-based irrigation (Figure 3.10).

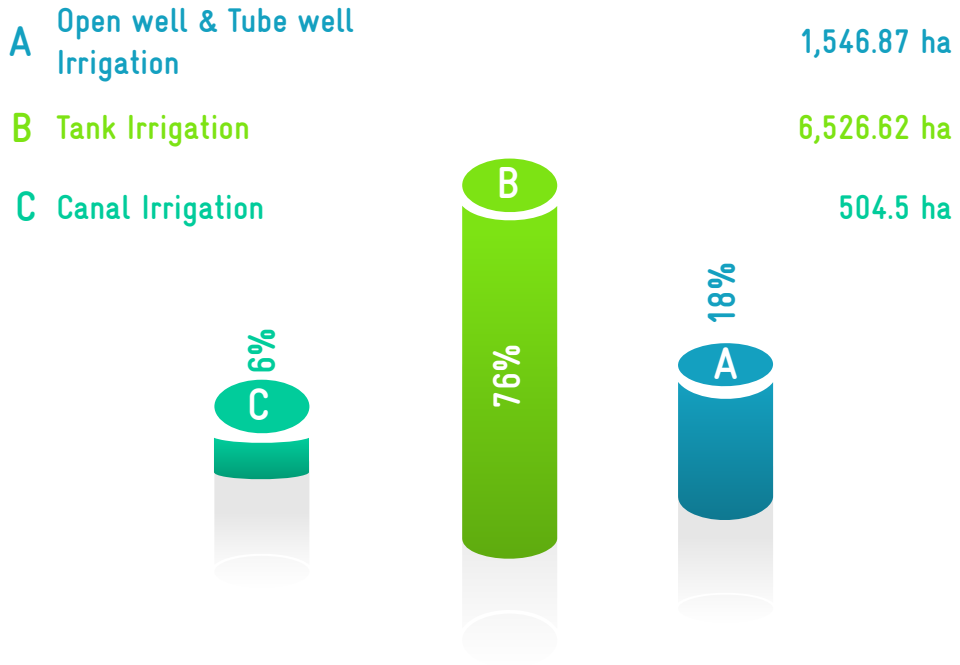


Figure 3.10. Irrigation sources

3.5.2.3 Available Run off

The total available runoff in the catchment area is 4,995.2 ha.m out of which highest of 69.75 % is from bad catchment area followed by 27.89 % is good catchment area and the remaining 2.36 % is of average catchment area. As the area has worse catchment area, the runoff generated is more (Figure 3.11).

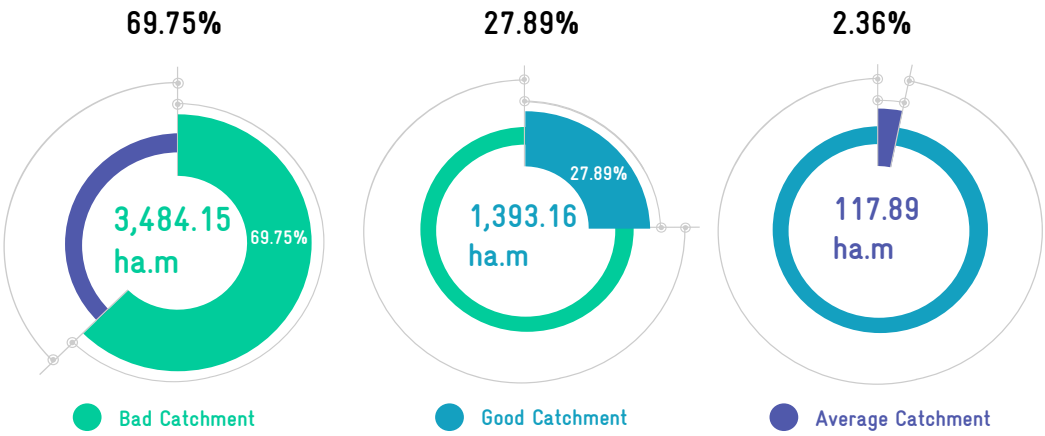
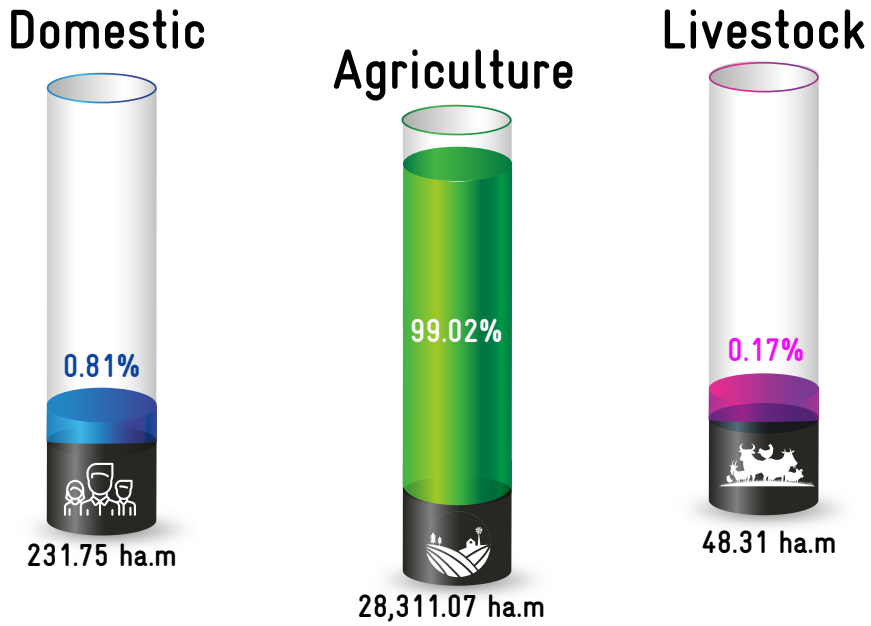


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 28,591.13 ha.m. The highest demand is from the agriculture sector of 28,311.07 ha.m (99.02 %) followed by domestic use demand of 231.75 ha.m (0.81 %) 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).

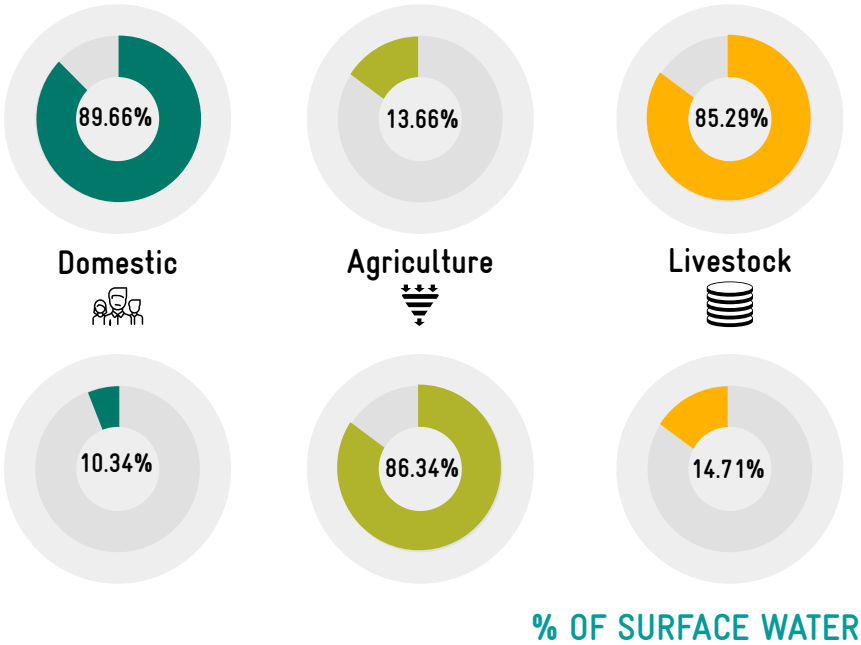


Figure 3.12. Sector-wise water utilization

3.5.3 ANALYSIS OF PHYSICOCHEMICAL PARAMETERS

Physicochemical parameters were assessed to understand their influences on nature of water through Water Quality Index (WQI), Seawater Mixing Index (SMI) and Salinity. To understand WQI and SMI, 28 water samples were collected across Block area, out of which 18 samples were of open well water and the remaining were from ground water (Figure 3.13).

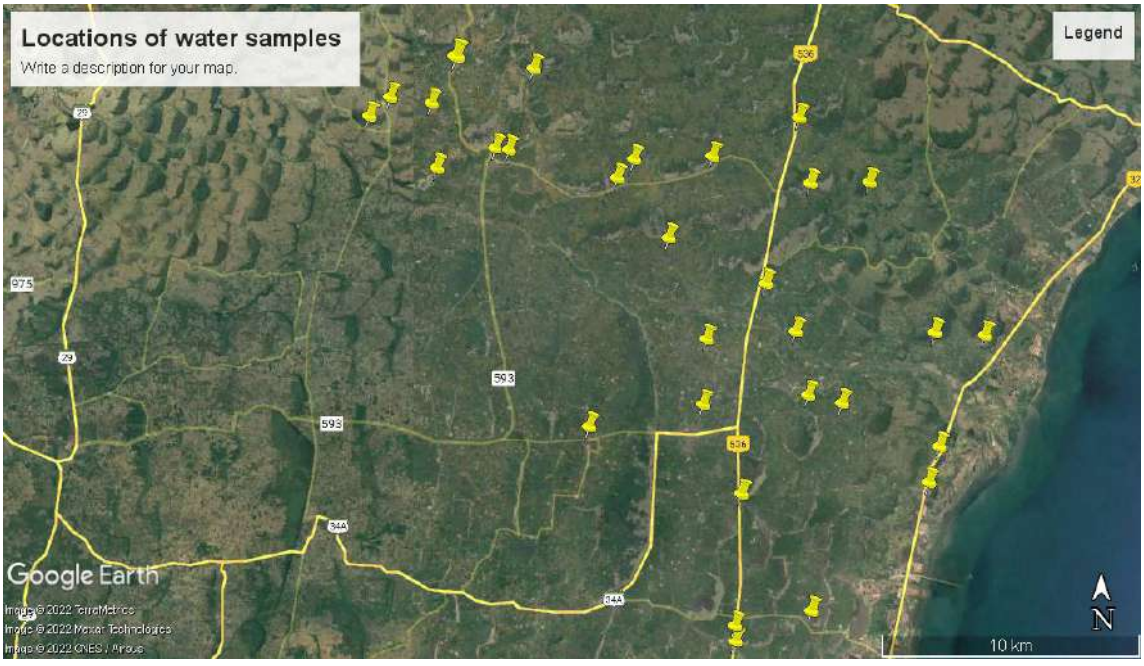


Figure 3.13. Location of water samples

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	Na	TH	TA	HCO_4	Ca	Mg	$S0_4$	CO_4	NO_4	K
Average in mg/l	1,396.38	546.55	520.28	366.43	276.8	246	176.13	78.56	72.966	32.467	29.31

(TH = Total hardness, TA = Titratable acidity, Ca =calcium, Na= Sodium, Cl= Chloride, HCO_3=Bicarbonate, Mg= Magnesium, SO_4= Sulphate, NO_3= Nitrate, K= Potassium, CO_4= Carbonate)

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

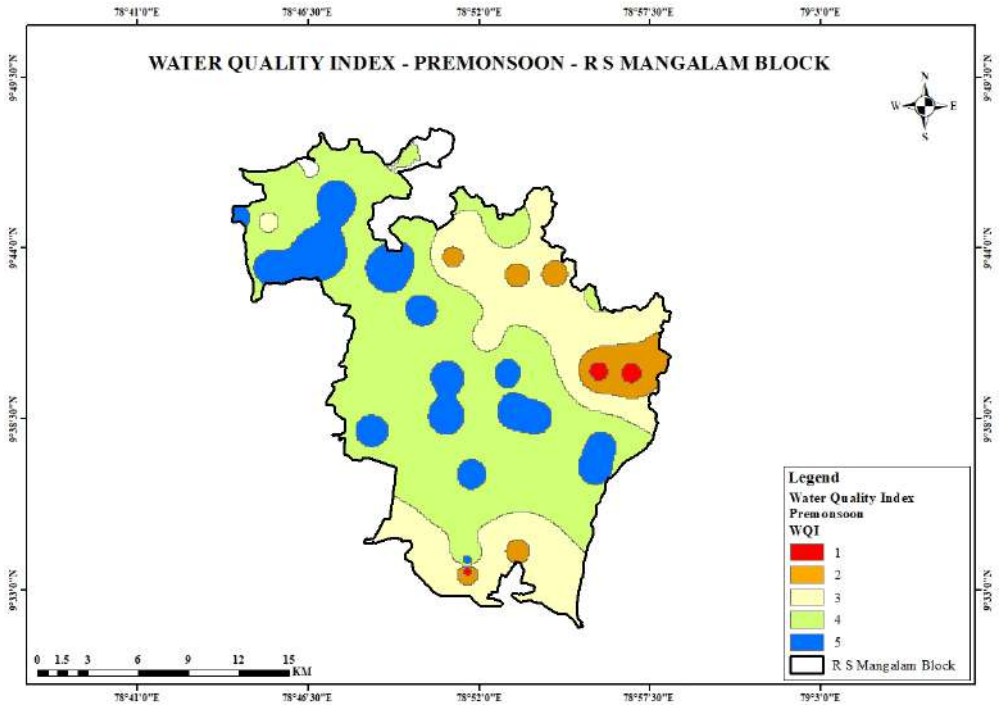


Figure 3.14. Water Quality Index

3.5.3.2 Seawater Mixing Index

SWI parameter is calculated based on mixing of major ionic constituents (Na, Cl, Mg, and SO4) of sea water to ground water during pre-monsoon season. The results show that the average content of ions was as follows: Na > Ca > Mg > S04. The predominant hydro-chemical facies are Sodium followed by Calcium while Sulphate is less. Geographically three spots were found with high SWI while three zones were 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).

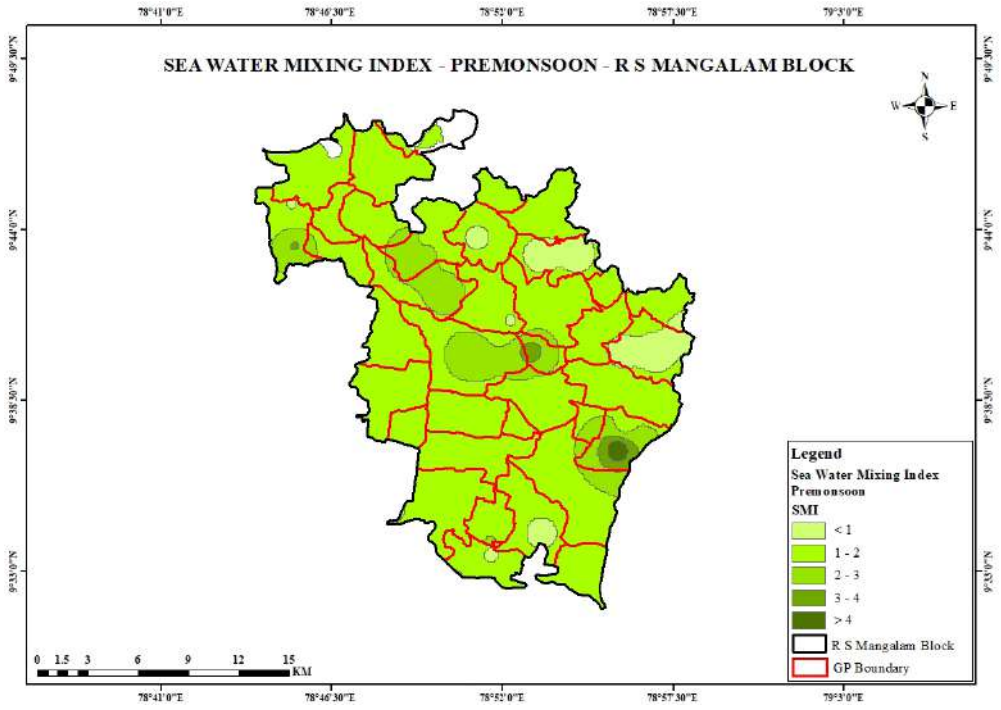


Figure 3.15. Seawater Mixing Index

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).

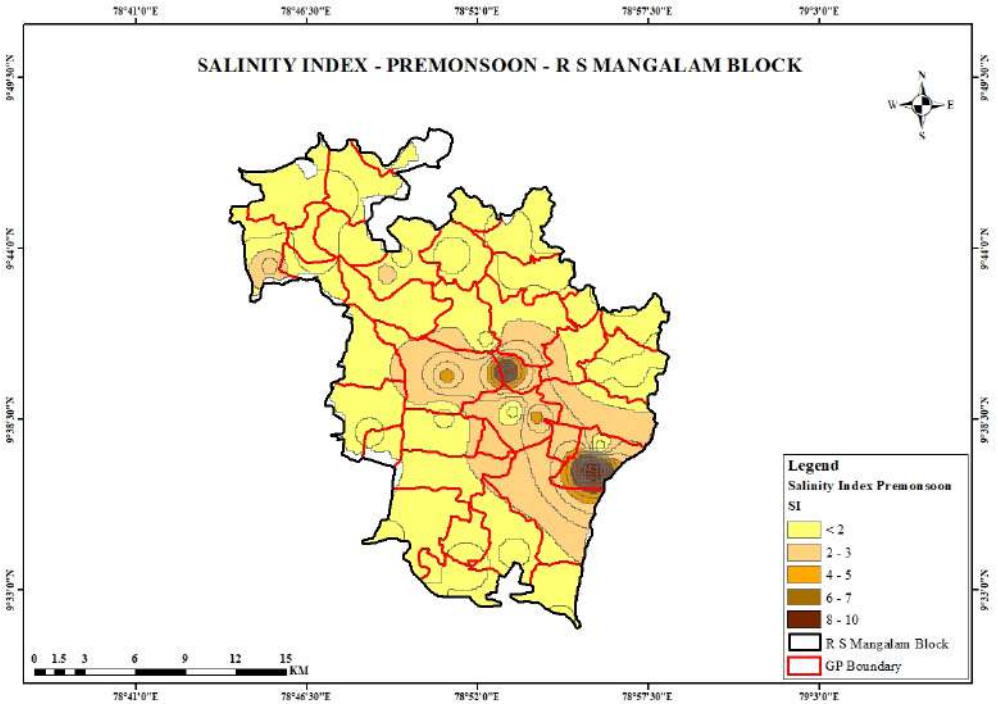


Figure 3.16. Salinity Index

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

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

3.6.1 SPATIAL DATA

Bhuvan based spatial data for LULC, waste land, salt affected land, soil erosion and soil texture were taken into consideration to understand R S Mangalam 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 and fine loamy 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.

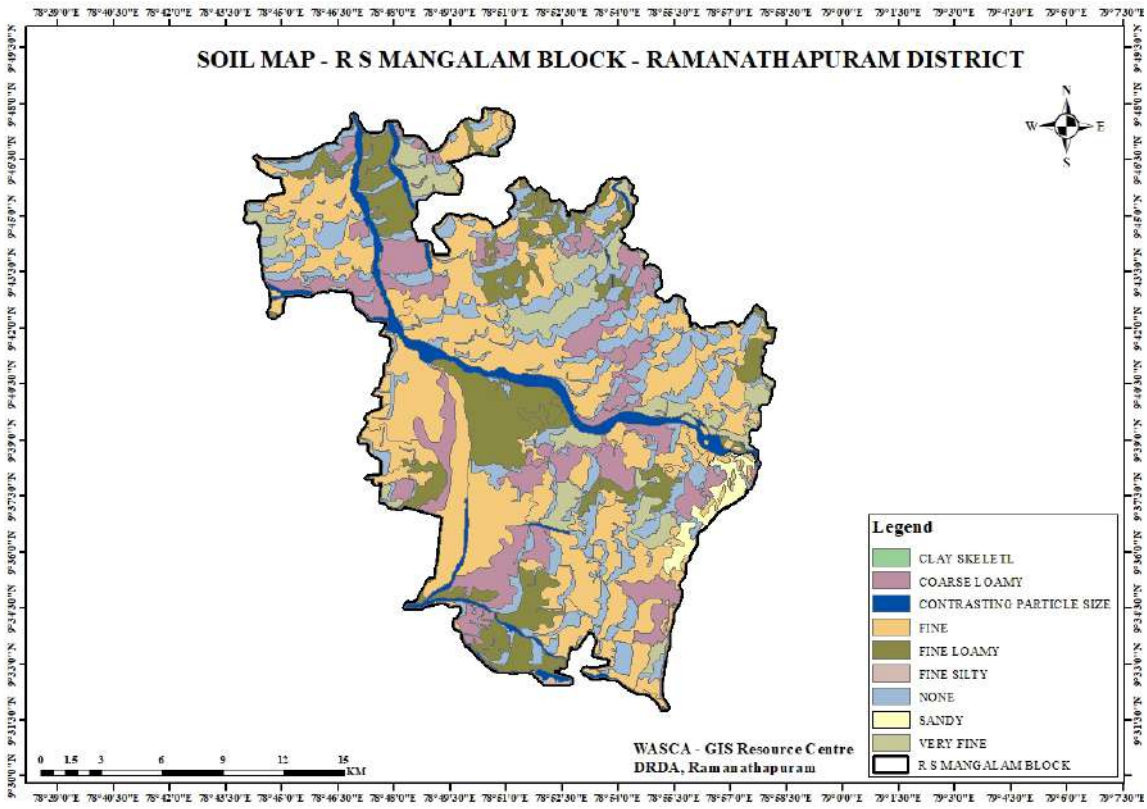


Figure 3.17. Soil texture

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 soil erosion sites are found in the Block (Figure 3.18) and the illustration below gives area wise soil erosion details respect to GPs. Soil eroded sites will help in preparing plans, to suggest soil conservation and watershed management activities.

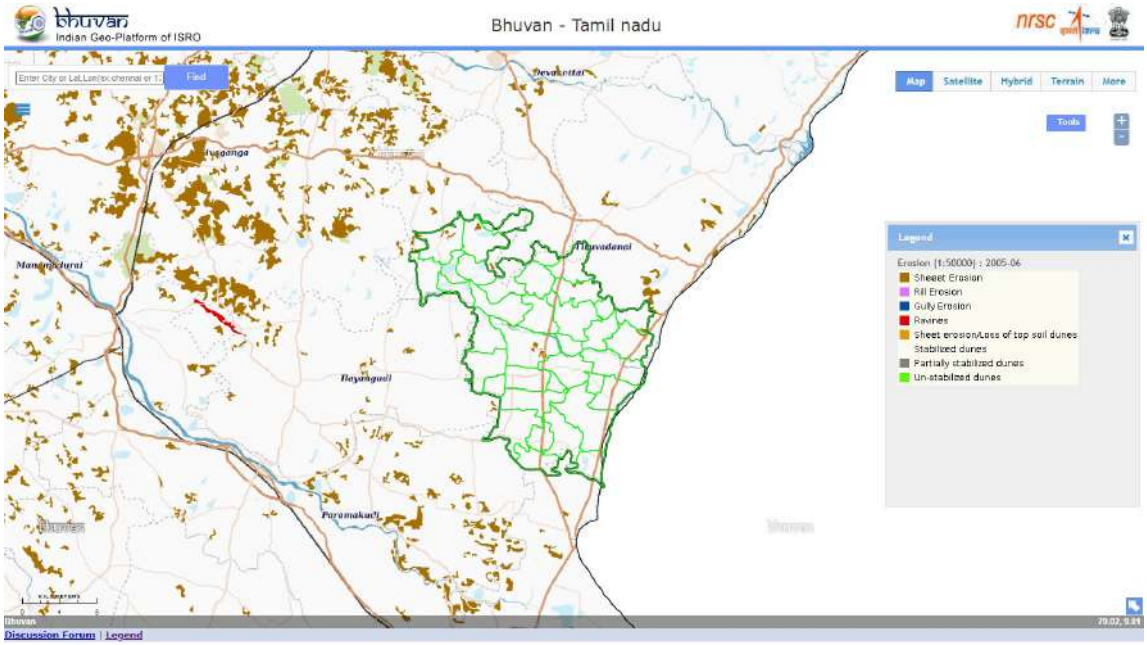


Figure 3.18. Soil erosion map

Erosion type	Area in %	Gram Panchayat
Sheet Erosion	5%	A Manakudi, Govindamangalam, Kottakudi, Melpanaiyur, Pullamadai, Radhanur

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. R S Mangalam Block is majorly covered by agricultural crop (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.

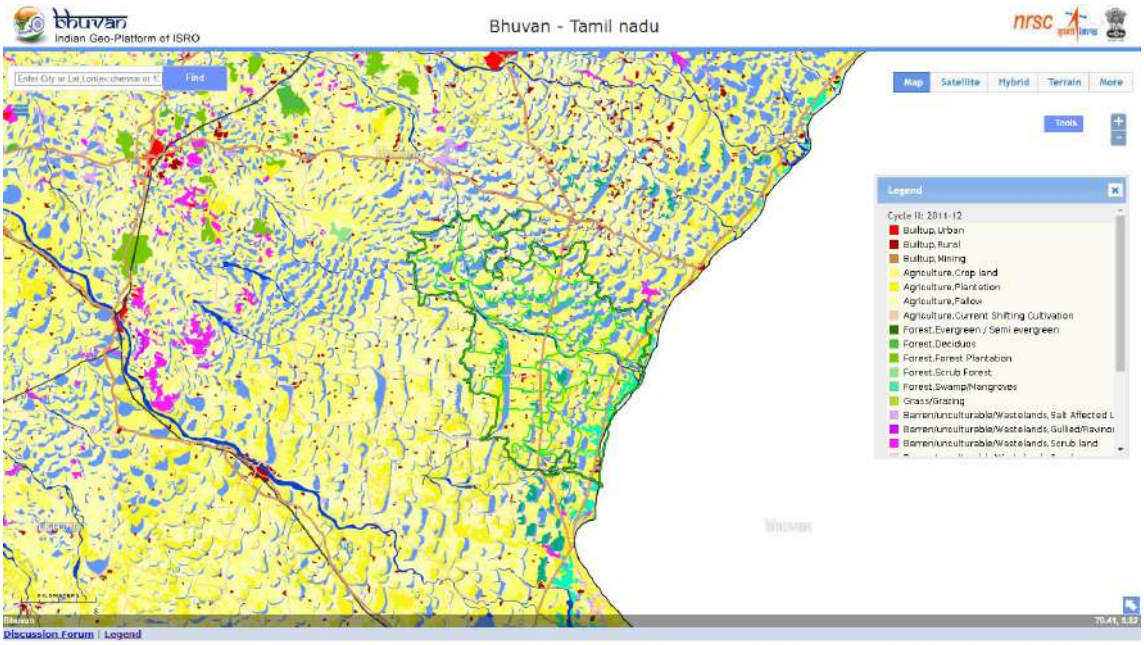
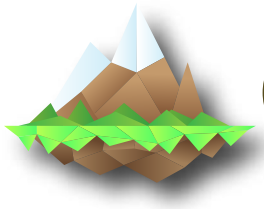


Figure 3.19. Land Use Land Cover map

Land Use	Area coverage in %	Gram Panchayat

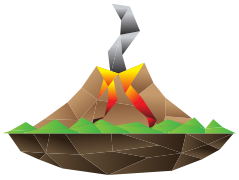
Forest, Evergreen/ Semi evergreen



11%

Varavani - 25%, Alagarthevankkottai, Kavanakkottai, Paranur, Sethidal, Thiruthervalai - 10%, Radhanur, Sirunakudi - 5%

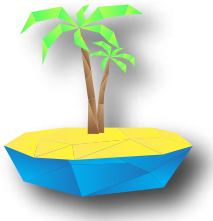
Forest, Swamp/Mangroves



23%

Kavanoor - 40%, Kadaloor - 35%, Chithoorvadi - 30%, A Manakudi - 15%, Tiruppalaikkudi - 10%, Kottakudi - 5%

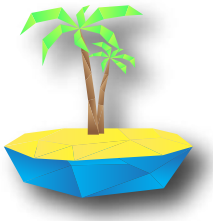
Agriculture, Fallow lands



40%

Sevvaipettai - 85%, Govindamangalam - 65%, Kavanakkottai - 40%, Sathanur, Thiruthervalai - 25%, Gudalur, Paranur - 20%

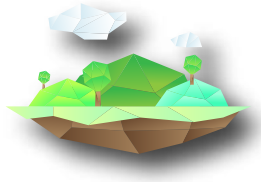
Agriculture, Crop lands



57%

Pullamadai - 90%, Odaikkal - 85%, Alagarthevankkottai, Kallikudi - 80%, A Manakudi, Sholandur - 70%, Chithoorvadi, Kottakudi, Thumbadakkakottai - 60%, Sanaveli - 55%, Kothidal_Kalakkudi - 50%, Paranur - 45%, Kadaloor, Karungudi - 35%, Kavanoor, Pitchangurichi, Uranagudi - 30%

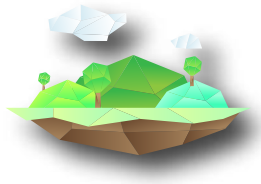
Agriculture, Plantation



17%

Sengudi - 45%, Karungudi - 15%, Kavanakkottai, Kavanoor - 10%, Varavani - 5%

Builtup, Rural



5%

Anandur, Govindamangalam, Kothidal_Kalakku, Pullamadai, Radhanur, Thumbadakkakottai, Tiruppalaikkudi, Uranagudi

3.6.1.4 Waste land: A Parcel of land that is not suitable for any agriculture activity and mostly covered with dense or open scrub is called as wasteland. The extent of wasteland will act as a direct input for preparation of plans for land development activities or greenery. Salt affected type wastelands is noticed in R S Mangalam 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.

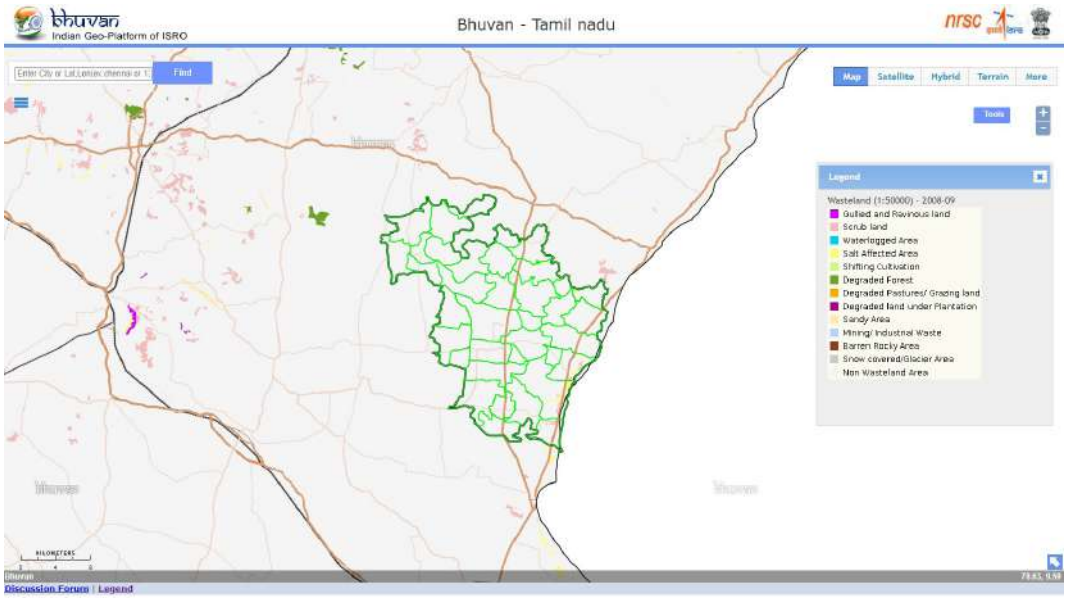
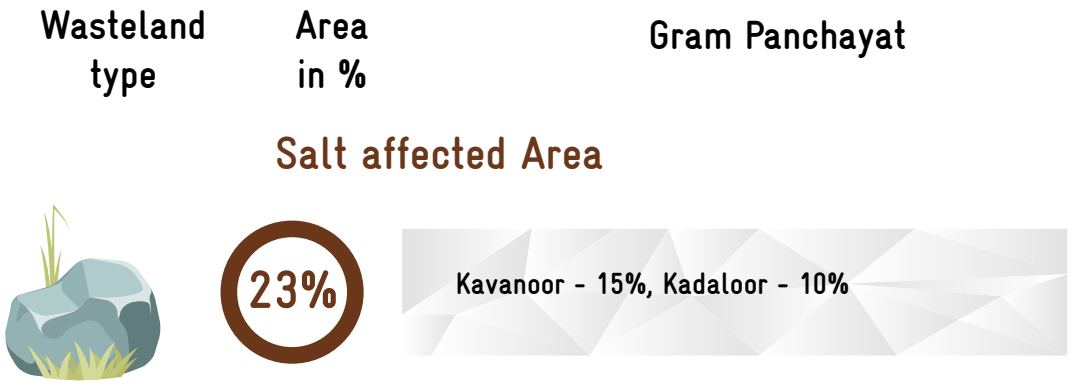


Figure 3.20. Wasteland map



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.

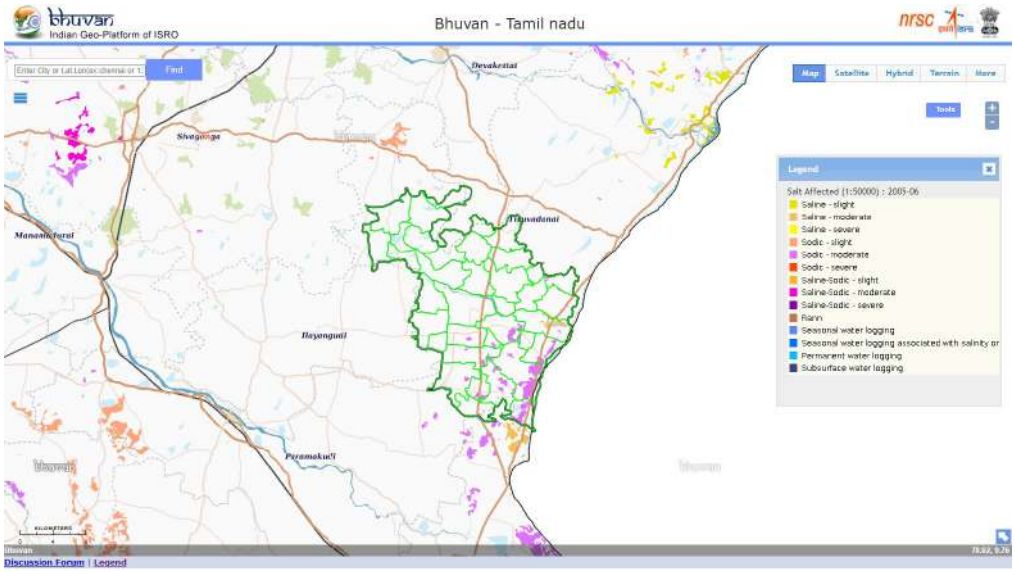


Figure 3.21. Salt affected area

Thematic unit	Area in %	Gram Panchayat
Sodic – Moderate		
	22%	Kavanoor - 45%, Paranur, Tiruppalaikkudi - 40%, Karungudi - 25%, Kothidal_Kalakkudi - 15%, Alagarthevankkottai, Sholandur - 10%, Chithoorvadi, Thumbadakkakottai - 5%
Saline -Moderate		
	10%	Chithoorvadi - 15%, A Manakudi - 5%

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.)	
Area under Forest land	19.10
Non-Agricultural Uses	5,836.31
Area under Barren & Un-cultivable Land	418.24
Area under Permanent Pastures and Other Grazing Land	3.80
Land Under Miscellaneous Tree Crops etc.	288.26
Cultivable Waste Land	400.81
Fallows Land other than Current Fallows	5,761.61
Current Fallow land	4,275.01
Unirrigated Land	9,632.62
Area Irrigated by Source	11,000.08
Land under Catchment Area (ha)	
Good Catchment	6,273.65
Average Catchment	692.87
Bad Catchment	30,669.32
Crop Details	
Irrigated Area (ha)	10,685.32
Rainfed area (ha)	12,457.24
Paddy Cultivation (ha)	22,786.24
Crop Water Requirement - Irrigated condition (ha.m)	15,973.35
Crop Water Requirement - Rainfed condition (ha.m)	12,337.67
Soil Resources: Status of Available Nitrogen (%)	
Very Low	15.94
Low	77.69
Medium	5.14
High	1.20
Very High	0.03
Status of Organic Carbon (%)	
Very Low	4.45
Low	33.75
Medium	20.00
High	31.76
Very High	10.04
Status of Soil Micro Nutrients (%)	
Sufficient	65.66
Deficient	34.34
Status of Physical condition of the soil (%)	
Strongly Acidic	0.29
Highly Acidic	3.60
Moderately Acidic	23.94
Slightly Acidic	12.16
Neutral	0.75
Moderately Alkaline	55.93

Strongly Alkaline	3.40
Soil Texture (%)	
Clay soil	1.66
Fine Soil	60.03
Coarse loamy	14.62
Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	17.00
Estimated Soil Moisture (ha.m)	5,448.73
ET Losses (ha.m)	11,433.76
Means of Water Extraction (%)	
Gravity	57.21
Lifting	42.83
Irrigation Methods (%)	
Wild Flooding	88.26
Control Flooding	11.74
Livestock (No.)	
Cattle Population	11,444
Sheep Population	6,539
Goat Population	9,438
Poultry	14,754

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 37,635.84 ha, the highest of 29.23 % land is irrigated by sources, followed by 25.59 % is unirrigated land, while less than a percent of land under miscellaneous tree Crops etc., forest land, permanent pastures and other grazing land found (Figure 3.22).

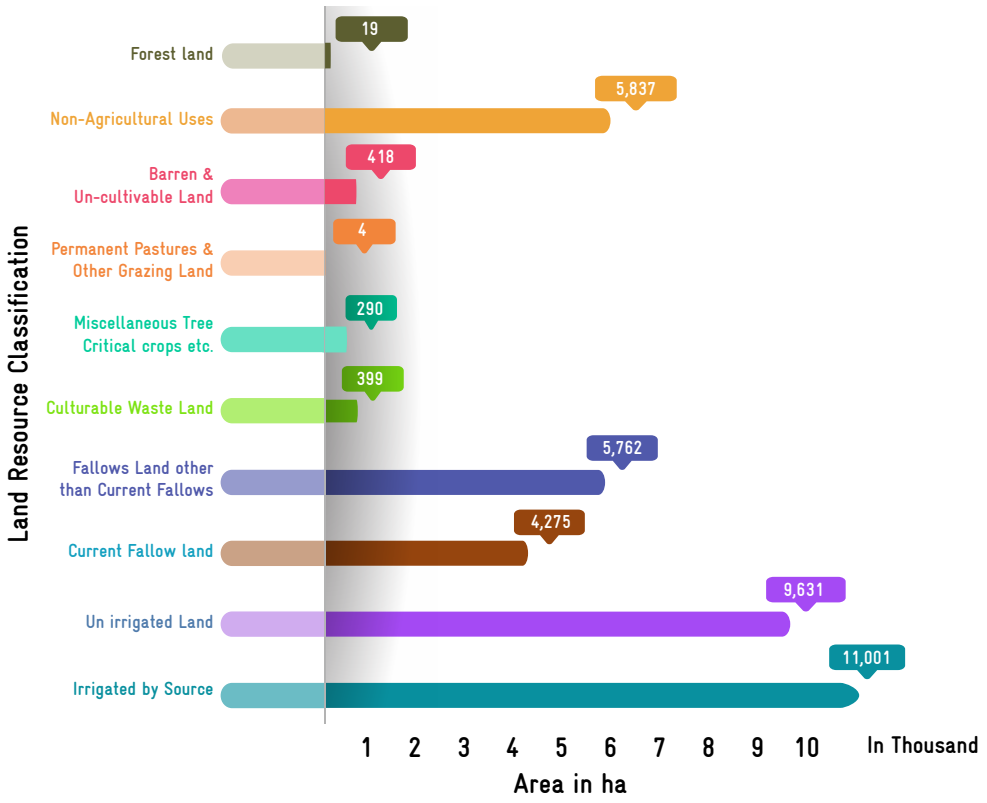


Figure 3.22. Land utilization

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 the total catchment area of 37,635.84 ha, of the Block, the highest of about 81.49 % is from bad catchment area followed by 16.67 % from good catchment area and remaining is under average catchment area. This analysis helps to focus on prioritizing the works in the land use systems under the good and bad catchment areas (Figure 3.23).

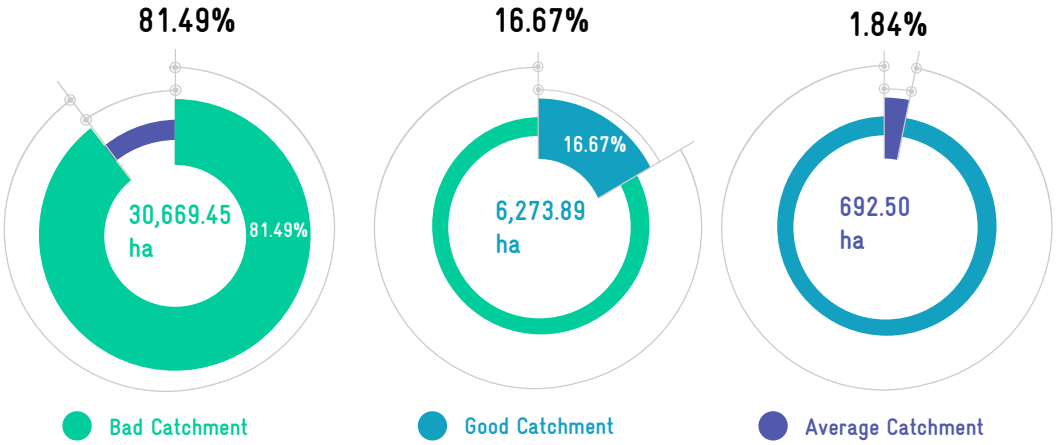


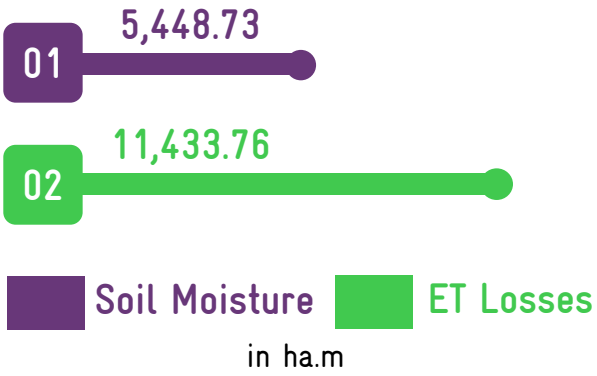
Figure 3.23. Catchment area

3.6.2.3 Soil moisture

Soil is an important medium to store the available water and the storage capacity varies with the type of soil especially its textural composition. In overall composite water budgeting, estimation of stored water in the soil assumes greater significance in this Block because of its significant proportion of area under rain-fed cultivation. The annual average volumetric soil moisture of this Block (17%), is taken for estimating the amount of water stored as soil moisture which accounts to 5,448.73 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 11,433.76 ha.m during 2018-19, with a monthly average of 799 ha.m.



3.6.2.5 Macro-nutrients
Nitrogen

The available nitrogen is low (77.69 %) in of the samples tested while it is high for 1.20 % of the tested samples (Figure 3.24). According to soil resource map, this Block is identified as one of the Nitrogen deficient Blocks (Ramanathapuram District profile 2020).

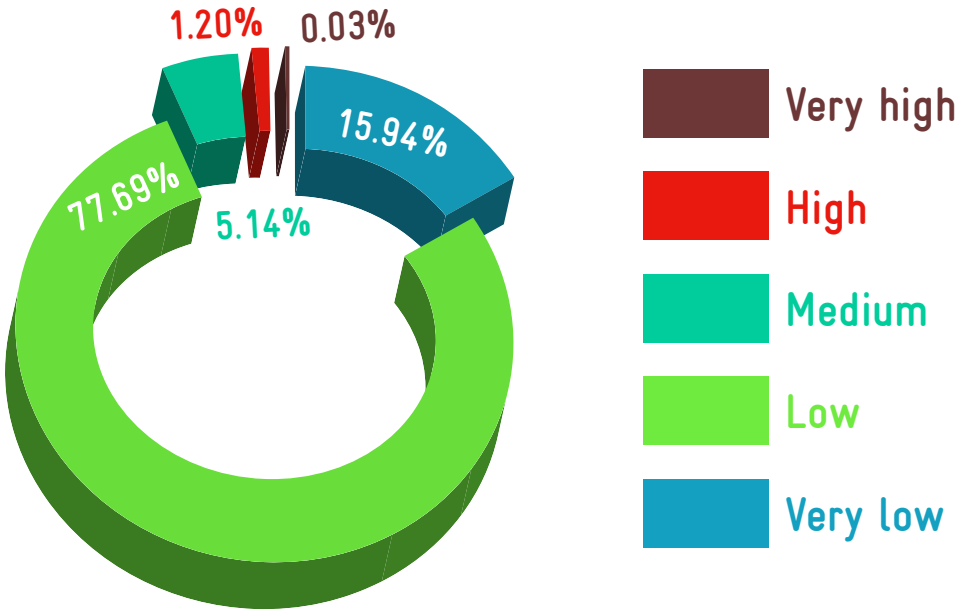


Figure 3.24. Status of available Nitrogen

Organic Carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. 33.75 % of the soil samples tested fall under low category followed by 31.76 % which falls under high category while less of 4.45 % samples are witnessed with very low organic carbon (Figure 3.25). This indicates that the soil fertility is moderately poor.

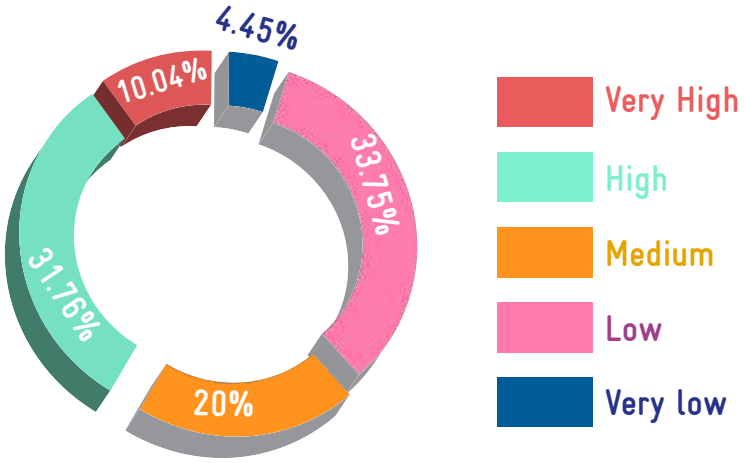


Figure 3.25. Status of soil Organic Carbon

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 34.34 % and 65.66 % sufficient in the soils tested (Figure 3.26).

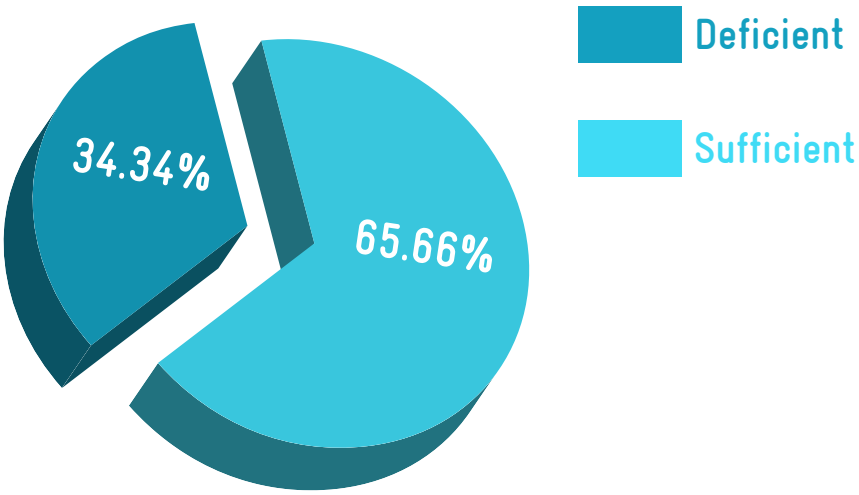


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 55.93 % of the soil is moderately alkaline in nature followed by 23.94 % is moderately acidic while 0.75 % is neutral (Figure 3.27).

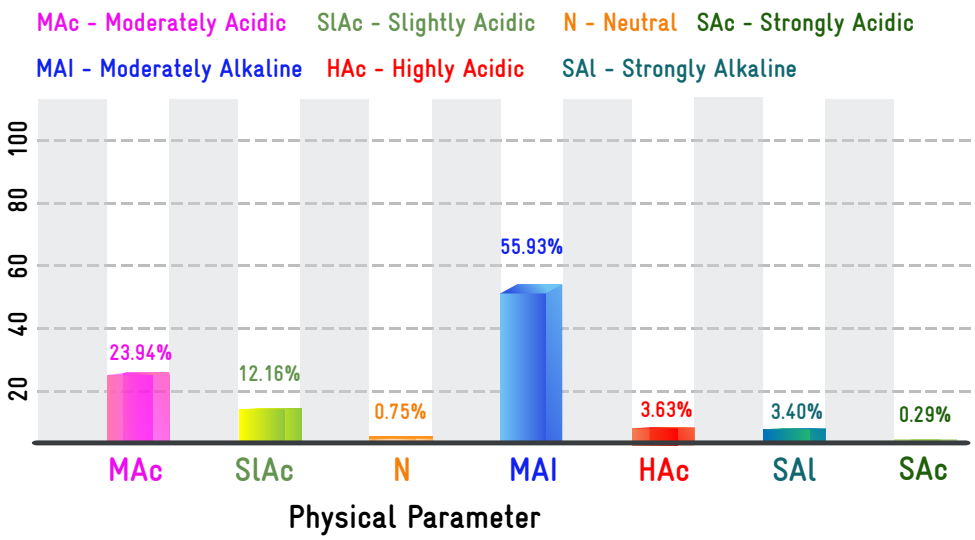


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

A total area of 5,396 ha is used for crop cultivation in which 55.3 % area is cultivated using irrigation sources and the rest or the area is cultivated using rain fed irrigation. Paddy is a dominant crop in both water source field which accounts to 70.19 % (3,787 ha) of total cultivated area followed by dry chilli of 17.04% while cultivation of minor millets, ragi, coconut, garlic, jowar, other pulses, sugar cane, maize, guava, brinjal, soybean accounts to less than one percent of the cultivated area.

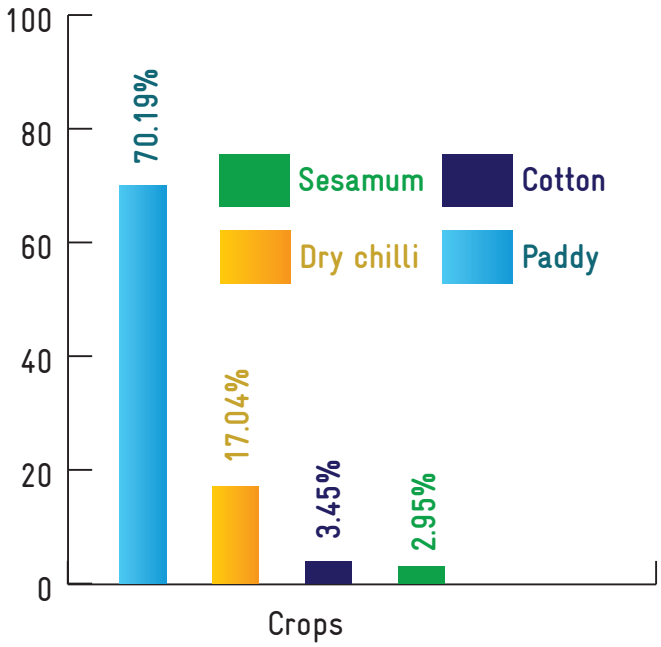


Figure 3.28. Crop pattern (including rain-fed and irrigation area)

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, 88.26 % of the irrigation is done by wild flooding and rest of irrigation is done by control flooding (Figure 3.29).

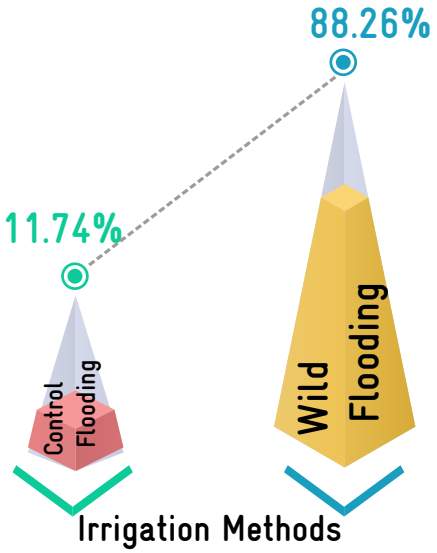


Figure 3.29. Irrigation methods

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, 57.21 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

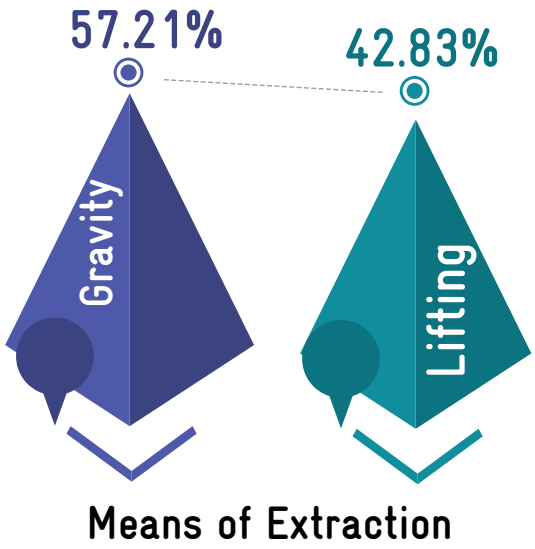


Figure 3.30. Means of water extraction

3.6.2.11 Livestock details

This Block has considerable proportion of livestock resources about 42,175. Of which small ruminants poultry populations is high 34.98 % (14,754) followed by goat of 22.38 % (9,438) and 15.50 % of sheep's (6,539), while cattle population is about 27.13 % (11,444) (Figure 3.31). The total water requirement for livestock is 48.3 ha.m. Of the total water demand of 85.29 % is met through ground water and remaining is from surface water resources.

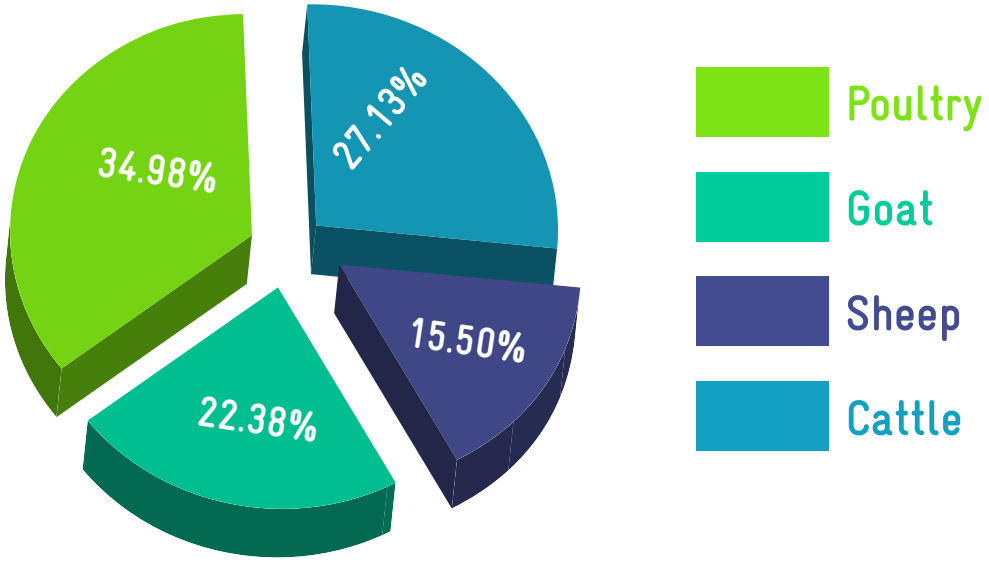


Figure 3.31. Livestock details

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 R S Mangalam Block. GP wise demographic and socio-economic status are attached in Annexure 3.11.

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

Parameter	Total
Geographical Area (ha)	37,141
Male Population (No.)	43,108
Female Population (No.)	43,246
Total Population (No.)	86,354
SC Population (No.)	21,296
Vulnerable Population (No.)	21,299
Households (HH's) (No.)	21,288
Only one room HH's (SECC) (No.)	2,364
Female Headed HH's (SECC) (No.)	1,171
Vulnerable Households (SECC) (No.)	2,007
% of Vulnerable Households (%)	11%
Registered MGNREGA Job cards (Persons)	23,945
Active person working in MGNREGA job Cards (Persons)	16,467
Drinking Water Sources (No.)	1,602
HH's have tap water connection for drinking water (No.)	12,560
HH's dependent on other sources for drinking water (No.)	10,479
Annual Greywater Generation (ha.m)	158

3.7.1 Population:

The total population of this Block is 86,354* in which the female proportion is slightly higher 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 25 % of the total population are under vulnerable population (Figure 3.32).

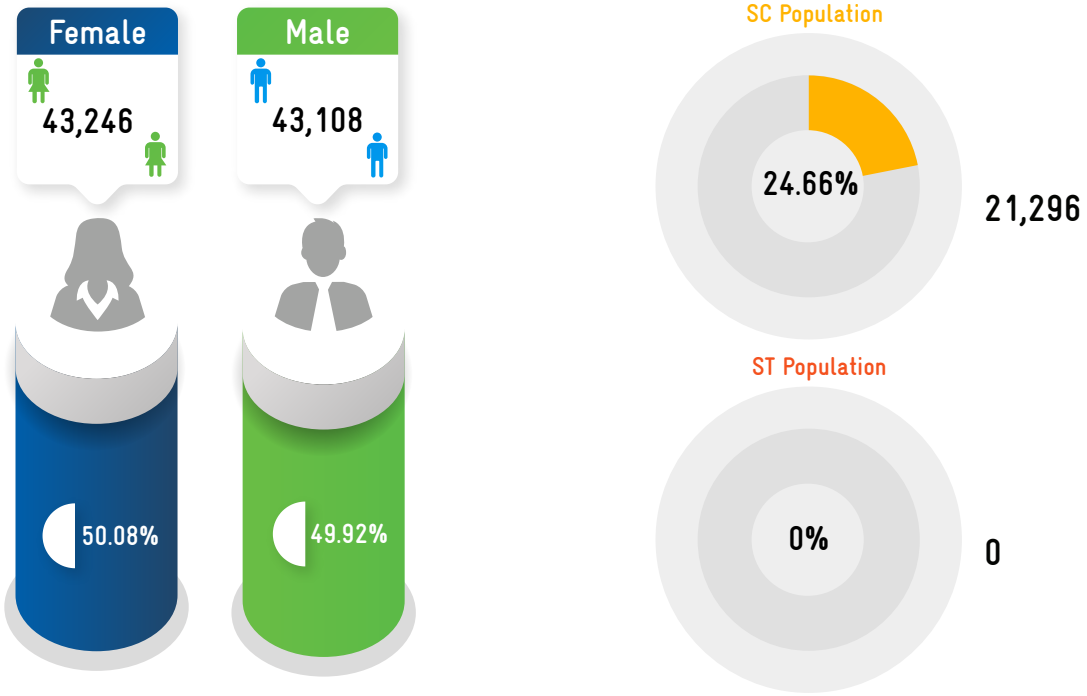


Figure 3.32. Population details

**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 21,288 households in which 11.1 % households have only one room, 5.5 % households are headed by women and 9.43 % are vulnerable households (Figure 3.33)

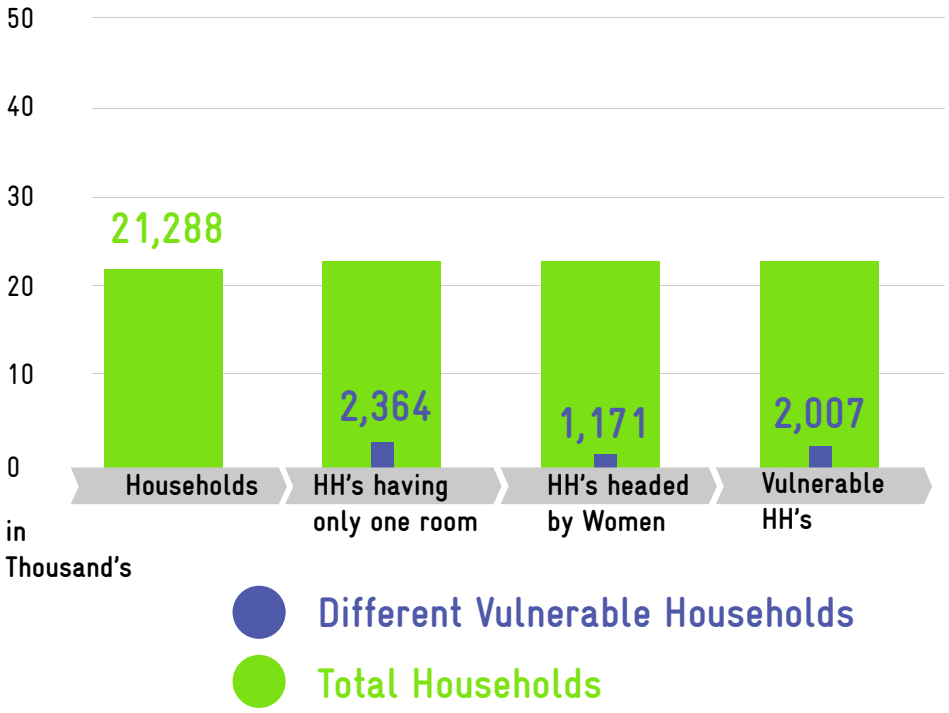


Figure 3.33. Details of households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 86,354, 23,945 are registered for job cards in Mahatma Gandhi NREGA scheme in which 68.77 % of the job cards are in active category (Figure 3.34)

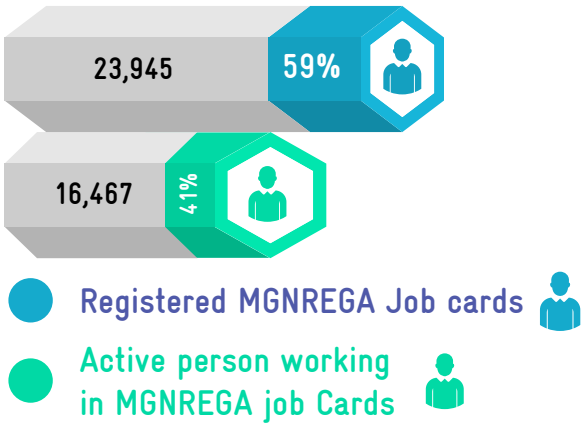


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 12,560 households have tap water connection and 10,479 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

12,560 Households

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

10,479 Households

3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 158 ha.m which is available for reuse or recycle.

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

Morphology

Alagarthevankkottai, R S Mangalam, Thumbadakkakottai

Soil erosion

A Manakudi, Govindamangalam, Kottakudi

Ground water prosperity

Tiruppalaikkudi, Kottakudi, Chithoorvadi, Ar Mangalam

Wasteland

Kavanoor, Kadaloor

Physicochemical parameters

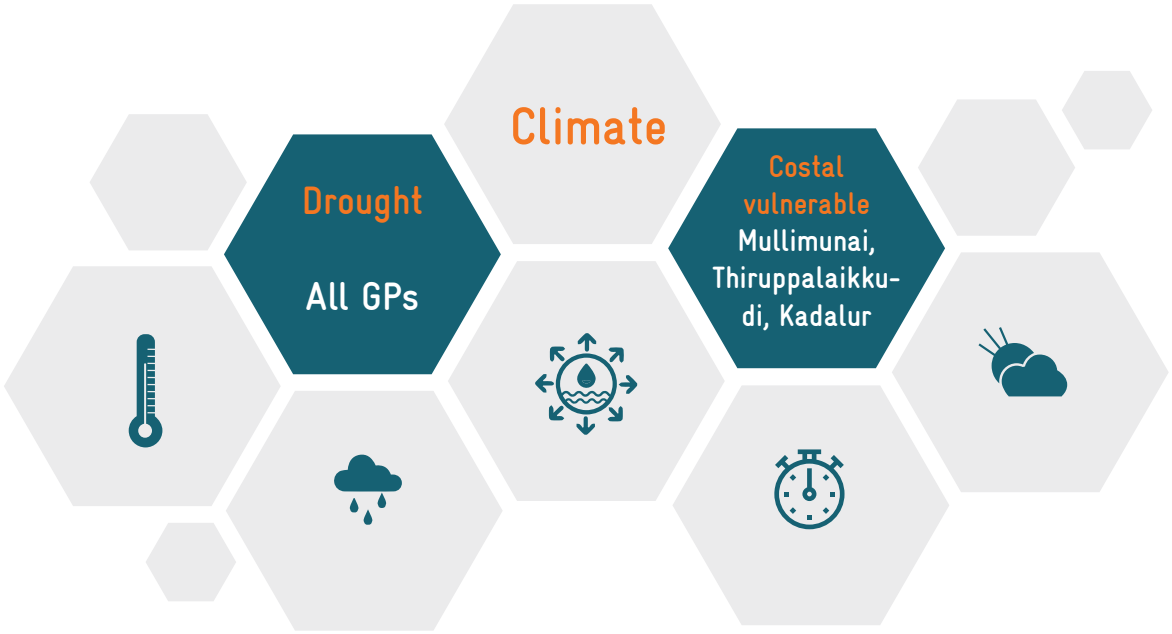
Kadaloor, Odaikaal, Solandur, Pullamadai

Salt affected area

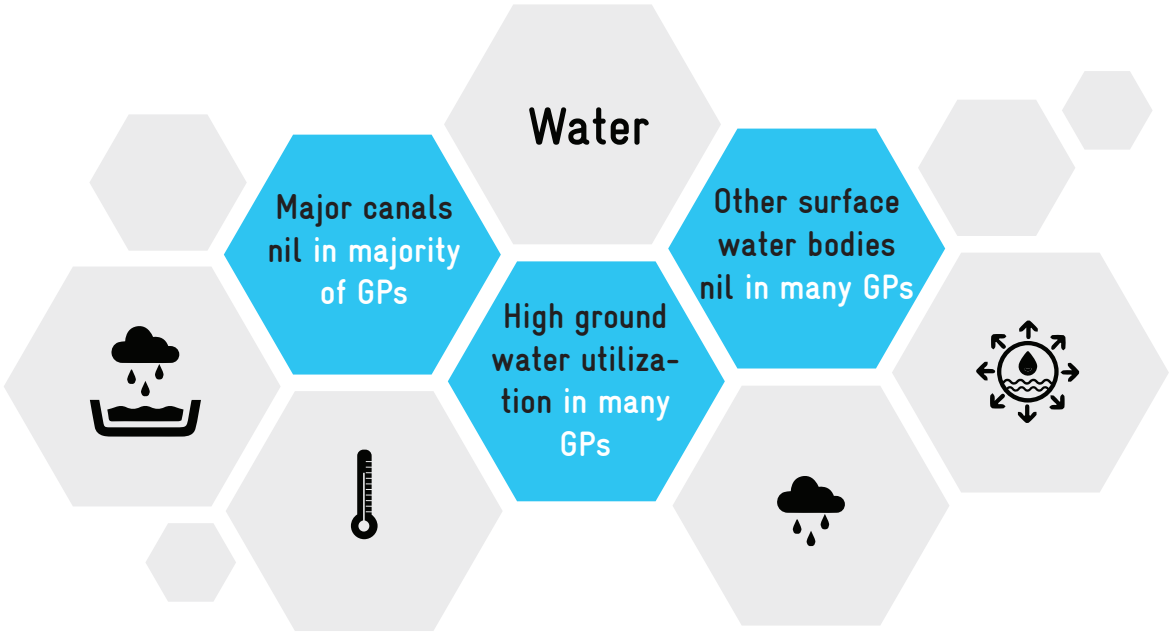
Kavanoor, Paranur, Tiruppalaikkudi

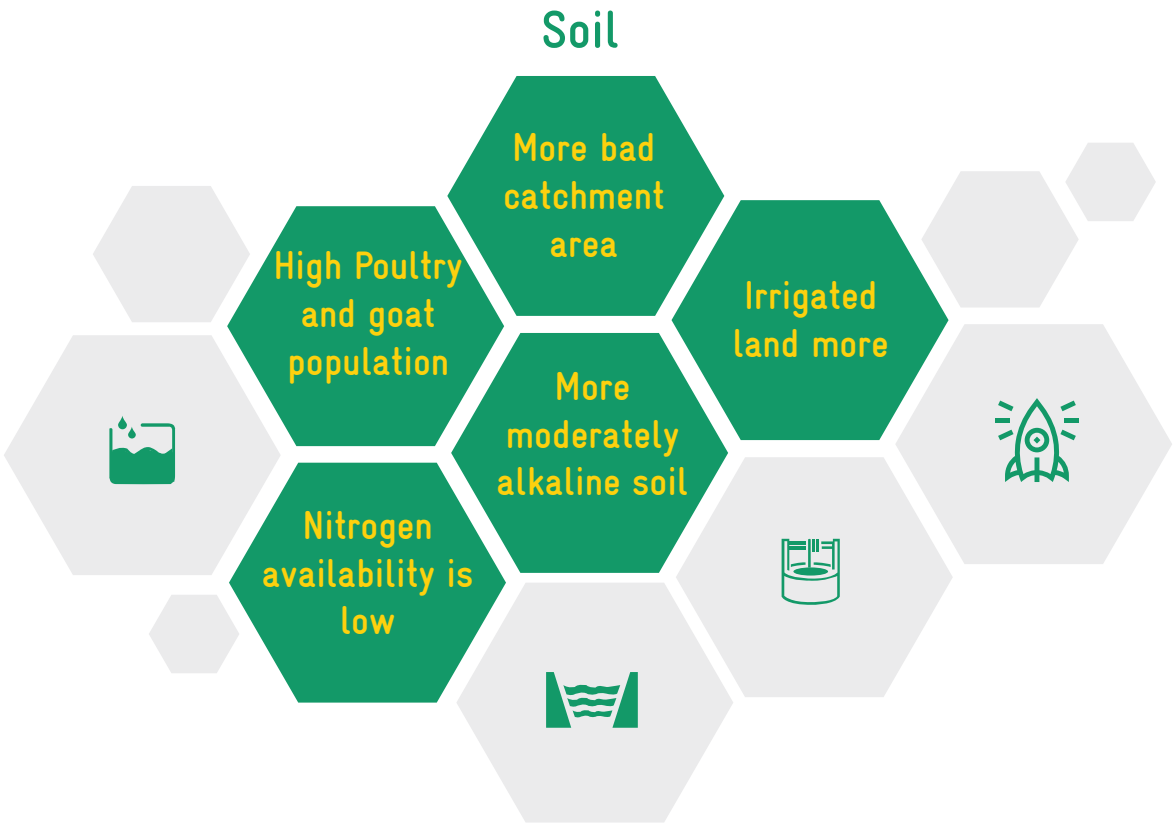
Upland/Slope

Tiruppalaikkudi, Radhanur


Climate
Drought
All GPs
Costal vulnerable
Mullimunai, Thiruppalaikku-di, Kadalur


Socio economic
Population density high in Kothaidal, Tiruppalaikkudi
Vulnerable population high in Tiruppalaikkudi, Kadalur, Kottagudi
% of vulnerable households high in Melapanaiyur, Odaikkal, Chiituruvadi
No. of households and female headed households high in Kottagudi, Govindamangalam, Sevvaipettai
Total population, Female population high in Tiruppalaikkudi, Kottagudi
Grey water generation more in Tiruppalaikkudi, Kottagudi
Most of GP HH's have tap water connection for drinking water high in Gudalur, Sana-velli, Tiruppal-aikkudi
Registered MGNREGA job cards and active persons working are low in Odaikkal, Anandur, Senkudi


Water
Major canals nil in majority of GPs
Other surface water bodies nil in many GPs
High ground water utiliza-tion in many GPs


Soil
More bad catchment area
High Poultry and goat population
Irrigated land more
More moderately alkaline soil
Nitrogen availability is low

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).

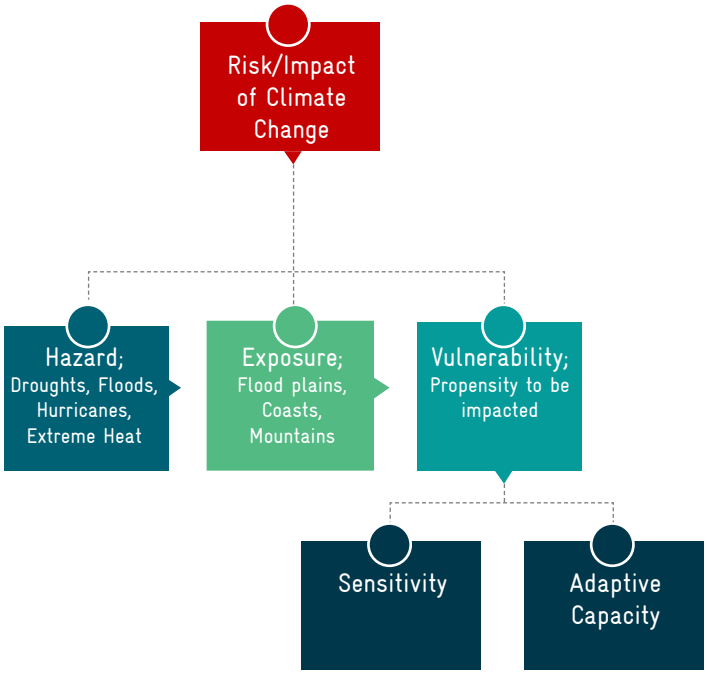


Figure 4.1. Vulnerability of the system as defined by IPCC

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.

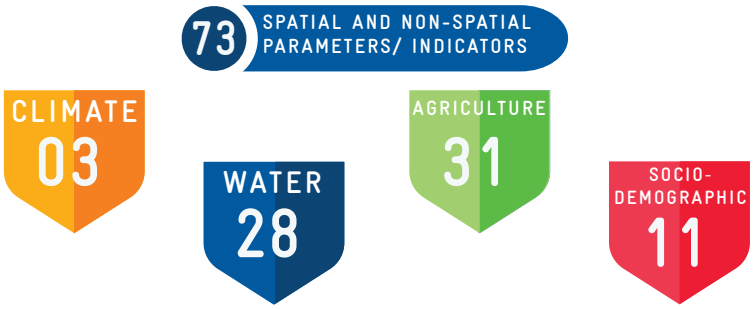


TABLE 9. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

	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. Kothaidal, Ayangudi, Tiruppalaikkudi, Sattanur, Karkathakudi, Kavanakottai, Chiituruvadi, Senkudi, Radhanur and Varavani GPs have very high rural water security vulnerability to climate risks followed by Thumbadakottai, Karungudi, Pitchanakurichi, Pullamadai, Govindamangalam, Melapanaiyur, Sanavelli, Urangudi, Sirunagudi, Thiruthervalai, Sethidal, Sholandur, Alagarthevankottai, Odaikkal, Kadalur, Paranur and Anandur GPs with high vulnerability. A.Manakudi GP has very low vulnerability.

Upto	Category	Color range
0.536	Very High	
0.503	High	
0.471	Medium	
0.438	Low	
0.405	Very low	

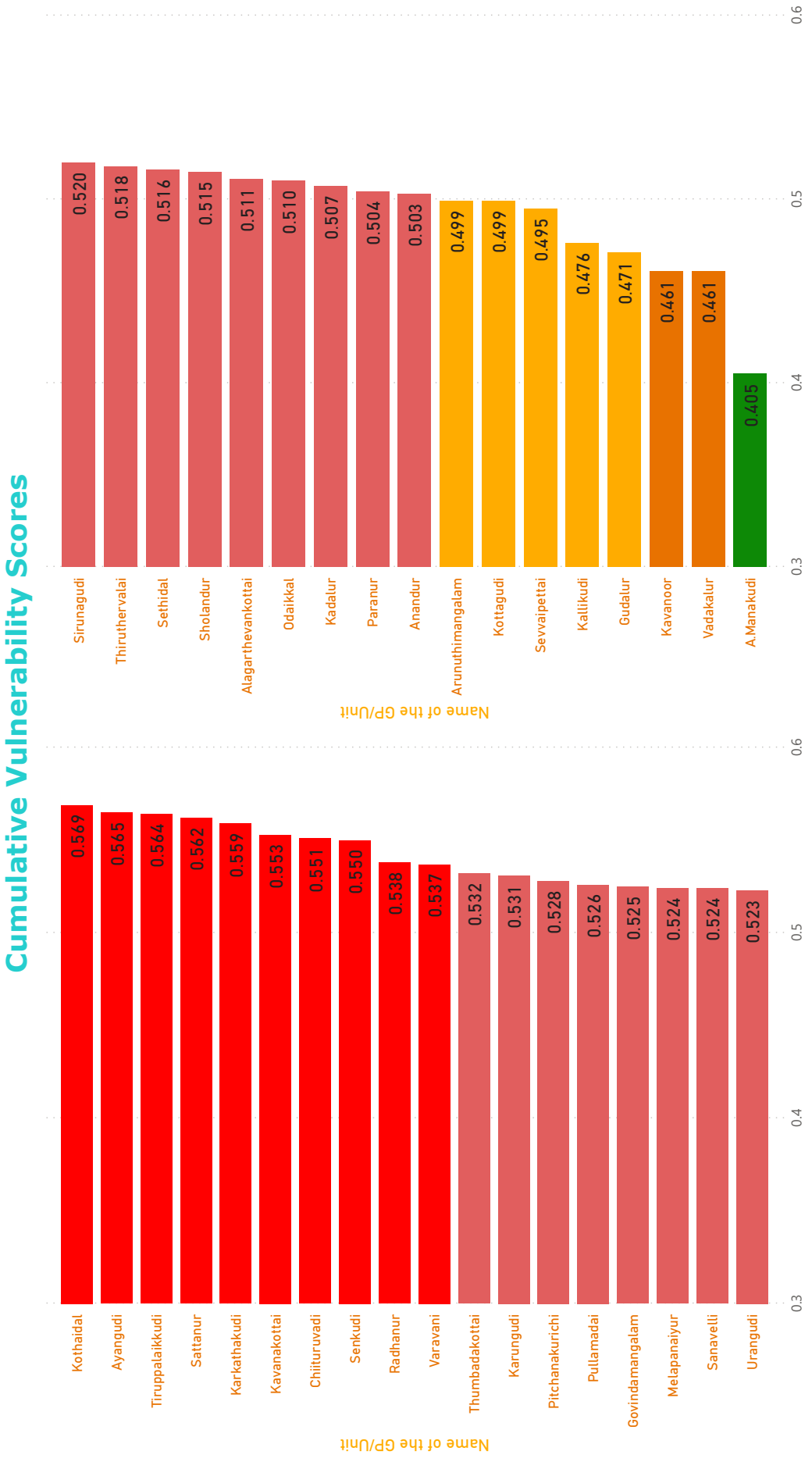


Figure 4.2. Final cumulative vulnerability scores

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.

ALL GPS

Coastal vulnerability hot spots

Thiruppalaikkudi, Kadalur, Mullimunai

THIRUPPALAIKKUDI, KADALUR, MULLIMUNAI

Water resource vulnerability

The water resources vulnerability index shows that Ayangudi, Kavanakottai, Sattanur, Pullamadai, Senkudi, Varavani, Odaikkal, Urangudi, Paranur, Karungudi GPs have high vulnerability

AYANGUDI, KAVANAKOTTAI, SATTANUR, PULLAMADAI, SENKUDI, VARAVANI, ODAIKKAL, URANGUDI, PARANUR, KARUNGUDI

Agriculture resources vulnerability

In agriculture and allied sectors, Karkathakudi, Radhanur and Kothaidal GPs have high vulnerability

KARKATHAKUDI, RADHANUR, KOTHAIDAL

Socio-economic vulnerability

Tiruppalaikkudi, Arunuthimangalam, Kothaidal, Chiituruvadi, Melapanaiyur and Kadalur GPs have high socio-economic vulnerability

TIRUPPALAIKKUDI, ARUNUTHIMANGALAM, KOTHAIDAL, CHIITURUVADI, MELAPANAIYUR, KADALUR

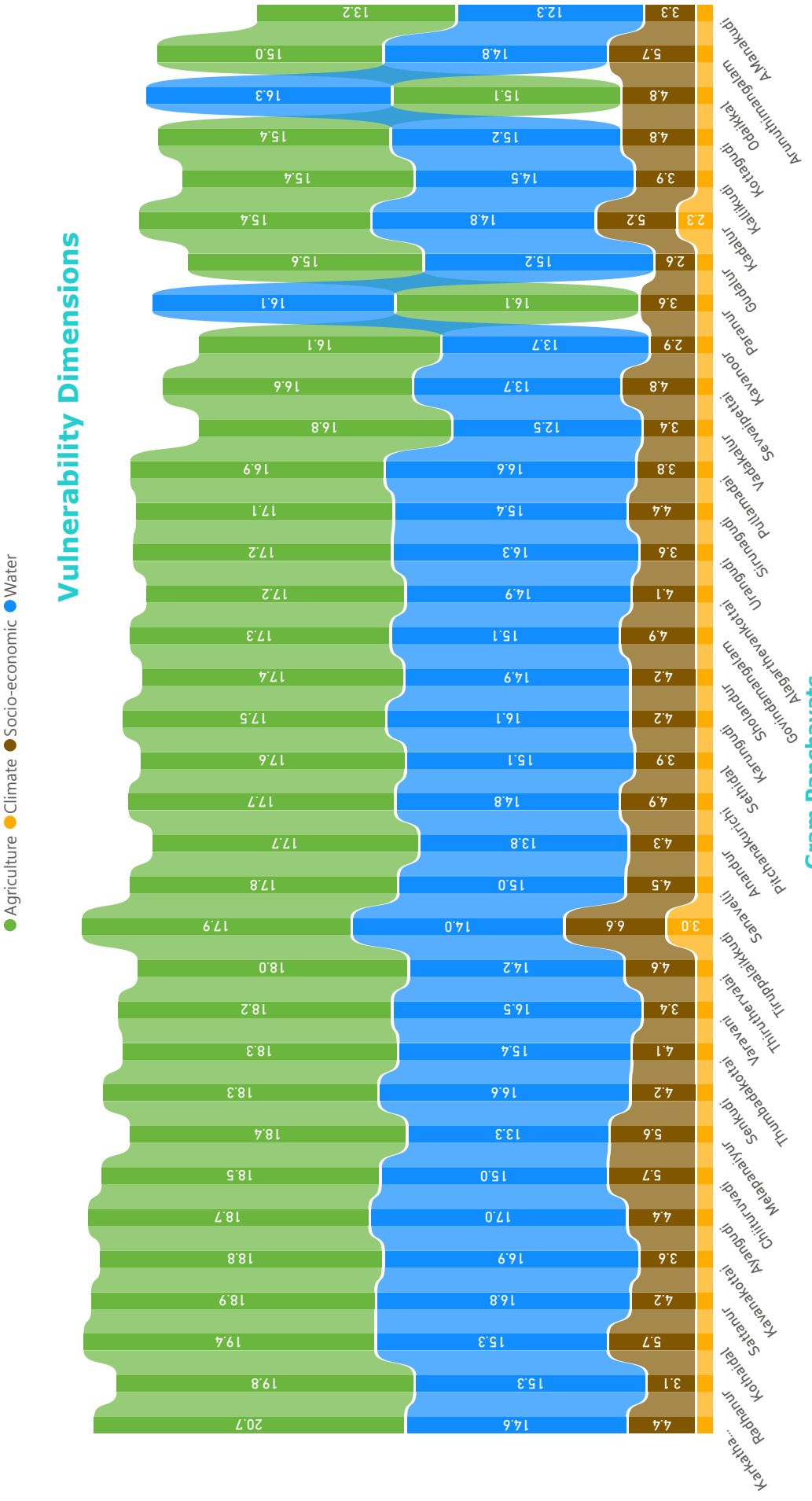
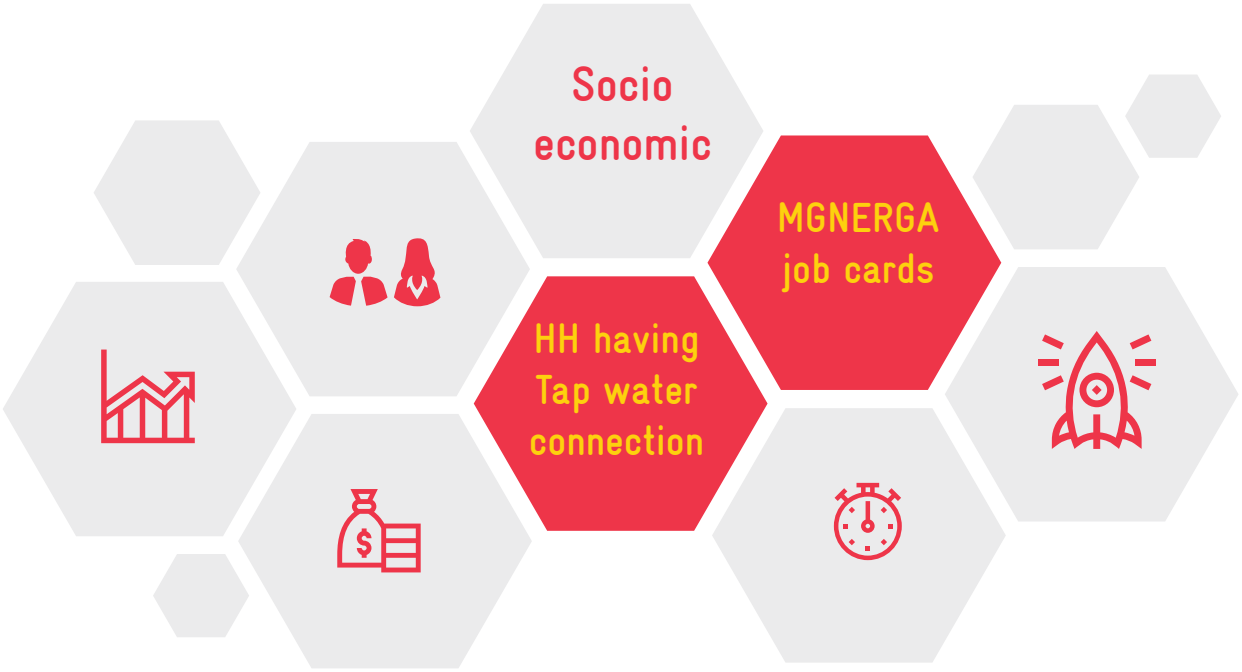
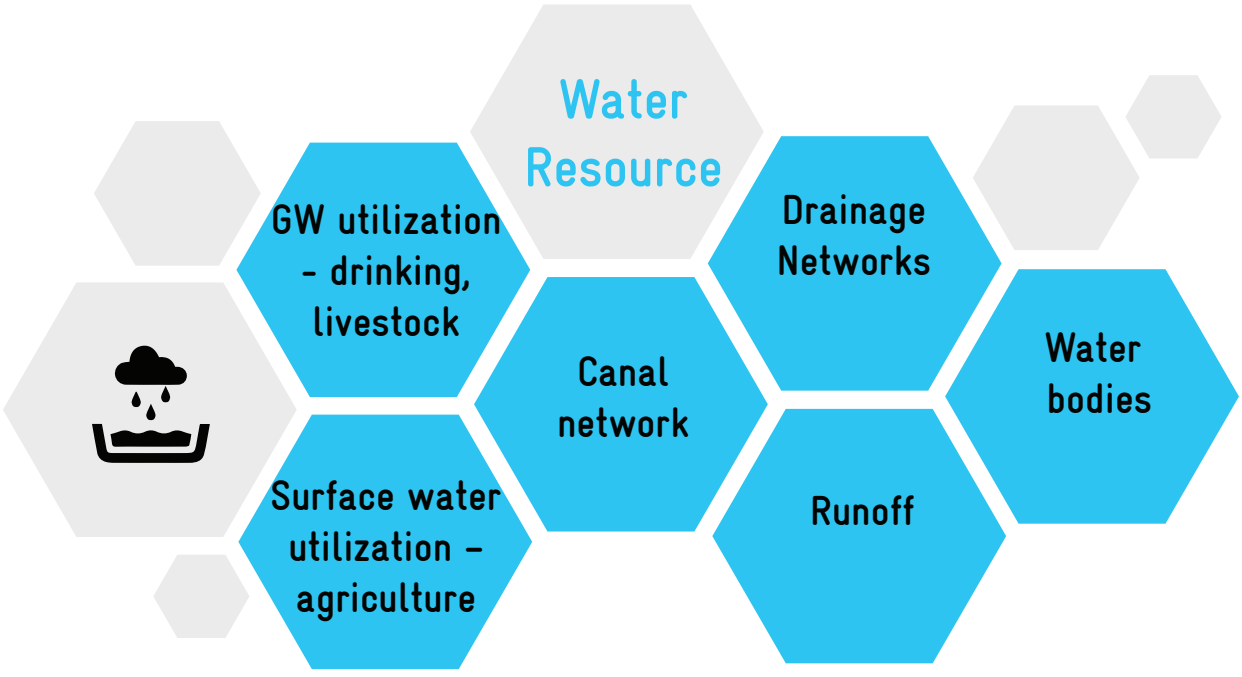
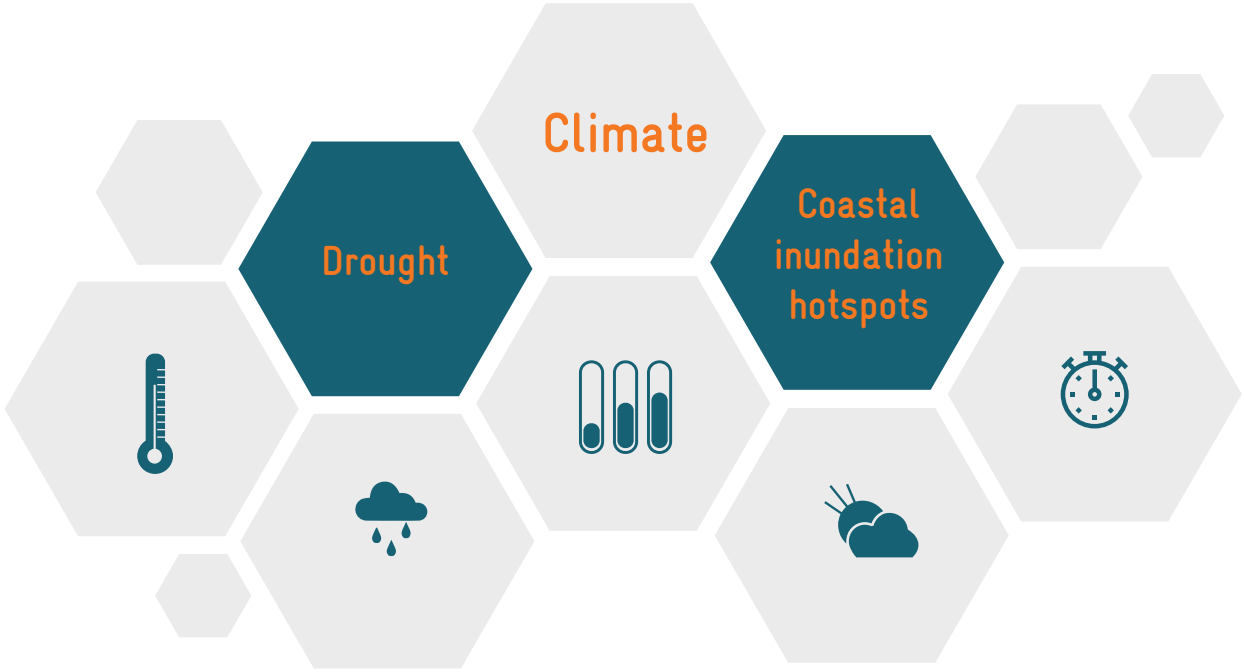


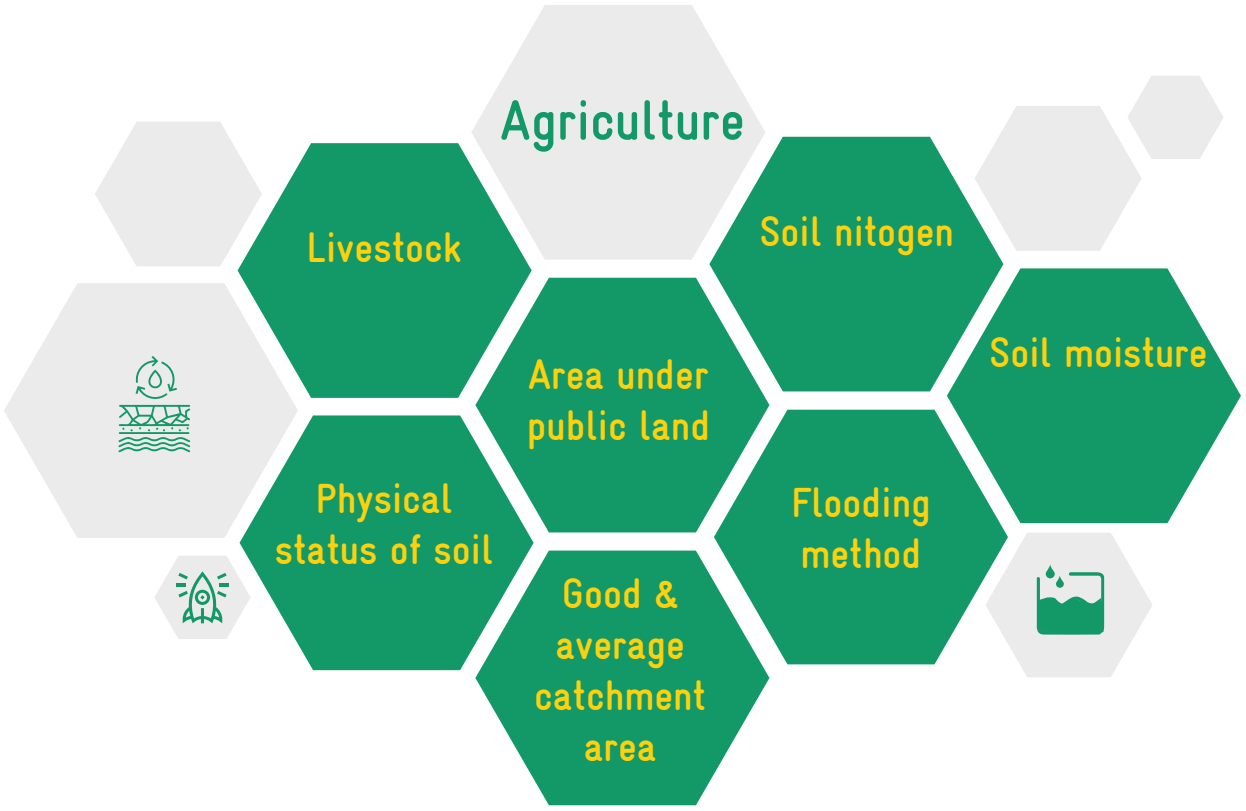
Figure 4.3. GP wise vulnerability dimensions

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).

5.1 THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 37,635.84 ha available land in R S Mangalam Block, 4,352.82 ha (11.56 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 1,047.07 ha of land of unirrigated (24.05 % of total proposed area), followed by 950.16 ha of irrigation land (21.83 % of total proposed area) while least of 3.26 ha area permanent pastures and other grazing land was considered for treatment. The detailed land wise proposal for WASCA treatments is given in the Table 1 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)
Unirrigated Land	9,632.62	1,047.07
Permanent Pastures and Other Grazing Land	3.80	3.23
Non-Agricultural Uses	5,836.31	396.08
Land Under Miscellaneous Tree Crops etc.	288.26	245.02
Forest land	19.10	7.64
Fallows Land other than Current Fallows	5,761.61	631.78
Current Fallow land	4,275.01	375.62
Cultivable Waste Land	400.81	340.71
Barren & Un-cultivable Land	418.24	355.51
Area Irrigated by Source	11,000.08	950.16

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 687.70 ha.m which is 14.10 % of the total runoff. Of the expected runoff conservation, the highest of 57.04 % good catchment area was considered for treatment followed by 28.86 % of bad and rest from Average catchment area (Figure 5.2).

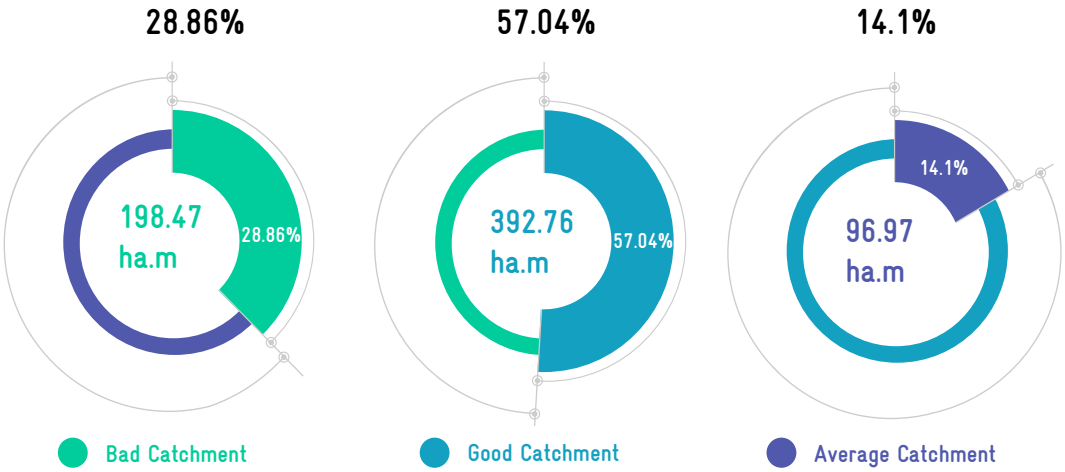


Figure 5.2. Expected conservation after WASCA treatment

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	270	2,689
Cattle Shelters (Number of units)	CS	270	2,689
Cattle Trough(Number of units)	CT	270	2,689
Fodder development - Community & Individual	FD	270	2,689
Goat Sheep Shelters (Number of units)	GSS	812	8,068
Poultry Shed (Number of units)	PS	293	2,940
Silvi-pasture Development (ha)	SPD	2,584	3
Soak Pits (Community) (Number of units)	SPC	204	20,552
Soak Pits (Individual) (Number of units)	SPI	2,057	20,552
Artificial Recharge Structure(Number of units)	ARS	770	1,925
Construction of Farm Ponds - Individual (Number of units)	FP	822	3,005

Restoration of water bodies:PWD and Union Tanks(Number)	RPWDT	212	
Restoration of water bodies:Ooranis(Number)	Roo	396	
Restoration of water bodies:Ponds(Number)	RP	1	
Roof Rain Water Harvesting (Number of units)	RRWH	70	
Water Course - Irrigation Channels - Desilting (Mtrs)	WCICD	51,001	
Afforestation in Public/common lands(ha)	Aff	6,01,254	759
Avenue plantation(km)	AVP	37,306	1,49,202
Block Plantation (Community)(ha)	BP	4,68,575	589
Canal Bund Plantation(ha)	CBP	14,314	57,236
Contour Continuous Bunds (CCB) for Afforestation area(Mtrs)	CCBF	1,51,841	759
Drainage Line Treatment (Mtrs)	DLT	19,079	76,310
Dry land Horticulture/Agro-forestry - Individual (ha)	DLHAI	599	1,500
Irrigation Channel Plantation (Mtrs)	ICP	12,754	51,001
Linear Plantation(km)	LP	23,725	94,900
Micro Irrigation(ha)	MI	378	950
Nursery Development (Number of units)	ND	1,02,760	20,552
Composting(Number of units)	Co	822	3,005
Farm Bunding with Boundary Trenches - Individual (ha)	FBBTI	1,203	3,005
Land development - Individual (ha)	LDI	412	1,027
NADEP Vermi compost (Number of units)	NADEP	270	2,689


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 9,725 ha area
More than 14 Lakhs plants planting
2,271 sites for WCWH
7,000 livelihood works

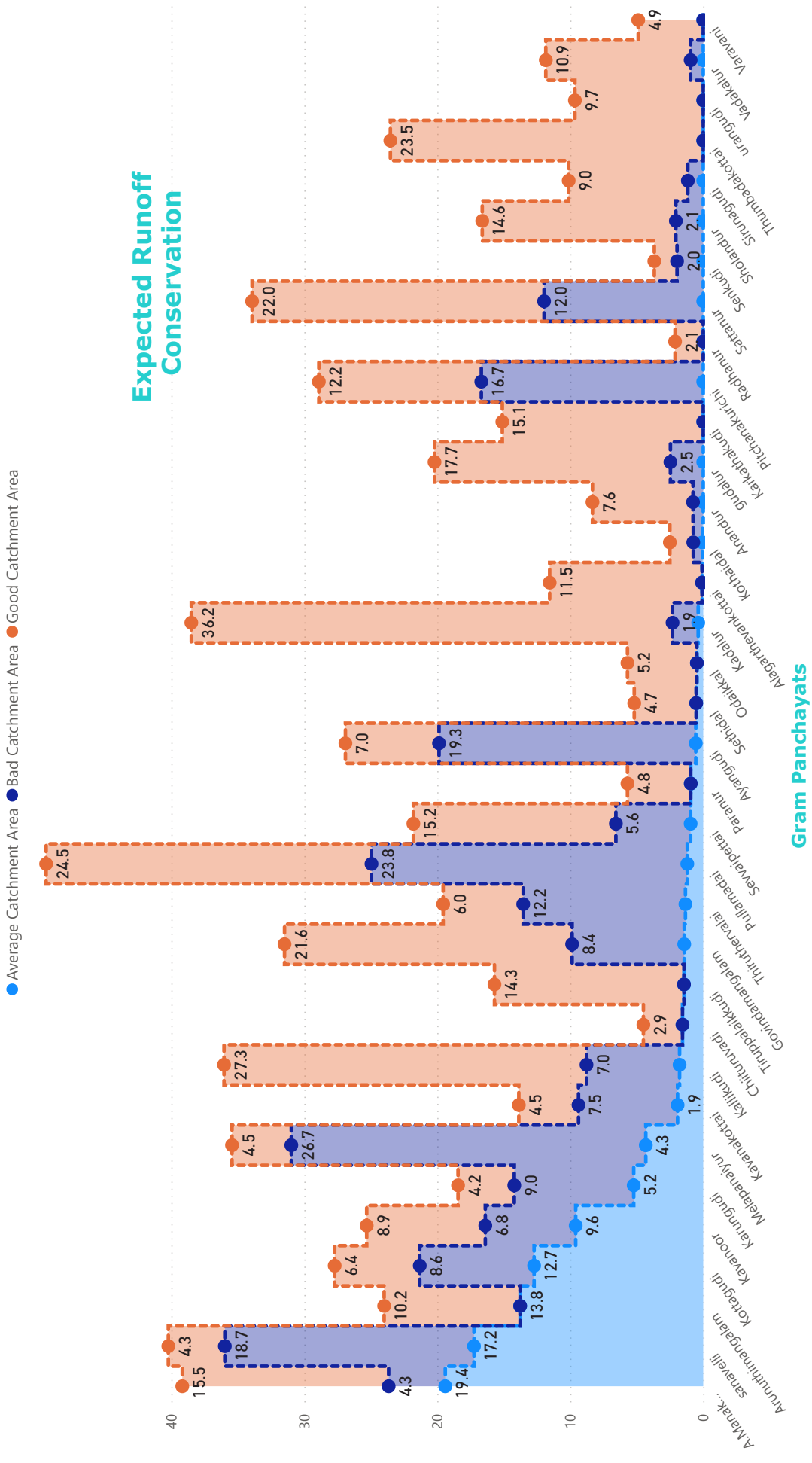


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

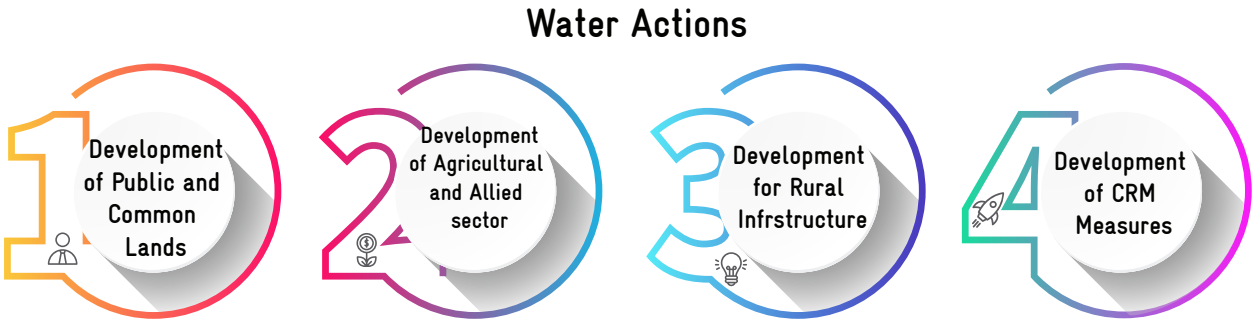
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

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)	3,037	10	0.025	75.92	30,368
COMPOSTING (NUMBER OF UNITS)	822	15	0.17	139.74	12,330
AFFORESTATION IN PUBLIC/ COMMON LANDS (ha)	759	3,344	8.6	6,527.40	25,38,096
BLOCK PLANTATION (COMMUNITY) (ha)	589	4,320	11.1	6,537.90	25,44,480
SILVI-PASTURE DEVELOPMENT (ha)	3	6,664	17.1	51.30	19,992
LINEAR PLANTATION (km)	95	703	1.8	170.82	66,715
CANAL BUND PLANTATION (ha)	262	2,930	7.5	1,965.08	7,67,689
IRRIGATION CHANNEL PLANTATION (m)	16,316	6	0.015	244.74	97,897
AVENUE PLANTATION(km)	149	703	1.8	268.56	1,04,889
NURSERY DEVELOPMENT (NUMBER OF UNITS)	514	2,344	15	7,707	12,04,347
RESTOTARATION OF WATER BODIES: PWD AND UNION TANKS (NUMBER)	227	800	5	1,135	1,81,600
RESTORATION OF WATER BODIES: OORANIS (NUMBER)	396	200	2	792	79,200
RESTORATION OF WATER BODIES: PONDS (NUMBER)	12	200	1	12	2,400
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	164	391	2.5	410	64,124
WATER COURSE - IRRIGATION CHANNELS - DESILTING (M)	16,316	3	0.0075	122.37	48,949
DRAINAGE LINE TREATMENT (m)	1,908	5	0.03	57.24	9,540

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)	529	2,930	0.1875	99.26	15,51,142
WETLAND PLANTATION (INNER) (ha)	13	2,930	7.5	101.3	39,467
COASTAL WETLAND - BUND STRENGTHENING (km)	2,563	977	0.0625	160.19	25,04,051
WETLAND INLET IMPROVEMENT WORKS (NUMBER OF UNITS)	81	3,906	10	810	3,16,386
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)	-	2,930	7.5	-	-

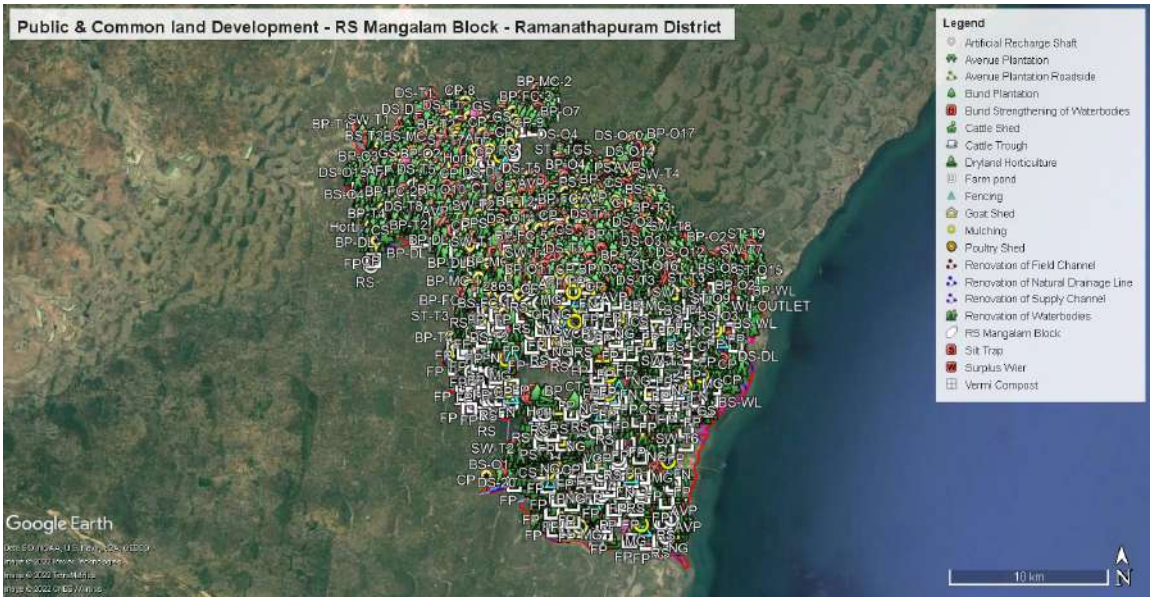


Figure 5.4. Proposed development activities in Public and Common land

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 livestocks 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)	3,005	586	1.5	4,507.50	17,60,930
MICRO IRRIGATION (ha)	378	-	1	378	-
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	822	781	2	1,644	6,41,982
LAND DEVELOPMENT - INDIVIDUAL (ha)	1,027	3,906	10	10,270	40,11,462
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	1,500	3,321	8.5	12,750	49,81,500
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	270	23	0.15	40.50	6,210
NADEP VERMI-COMPOST (NUMBER OF UNITS)	270	27	0.18	48.60	7,290
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	270	2,344	1.48	399.60	6,32,880
CATTLE SHELTERS (NUMBER OF UNITS)	270	331	2.12	572.40	89,370
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	270	355	2.27	612.90	95,850
CATTLE TROUGH (NUMBER OF UNITS)	270	6	0.05	13.50	1,620
POULTRY SHED (NUMBER OF UNITS)	293	10	0.09	26.37	2,930

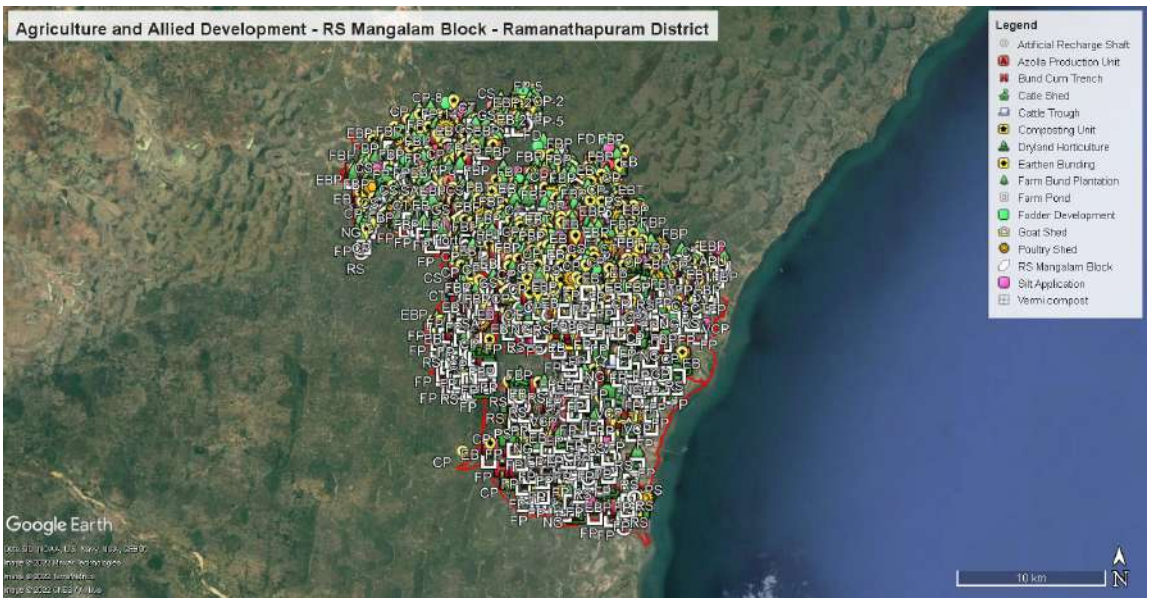


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

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)	204	20	0.13	26.52	4,080
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	2,057	16	0.1	205.70	32,912
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	70	625	4	280	43,750
TANKA - COMMUNITY LEVEL (NUMBER OF UNITS)	-	300	30	-	-

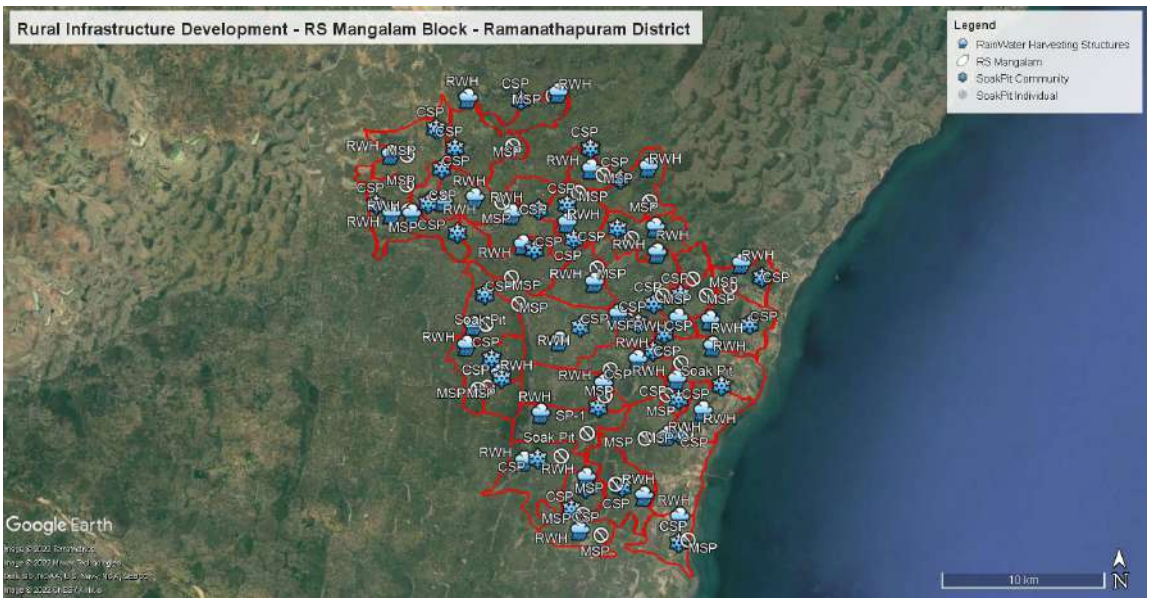


Figure 5.6. Proposed Rural Infrastructure activities

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 plantation (Table 17), Avenue plantation (Table 18), mini forest (Table 19), tanka (Table 20), Block nursery development (Table 21), GP level nursery development (Table 22), and cascade of tanks (Table 23) were proposed in this Block in saturation mode. Among the activities mini forest works are more in number followed by tanka.

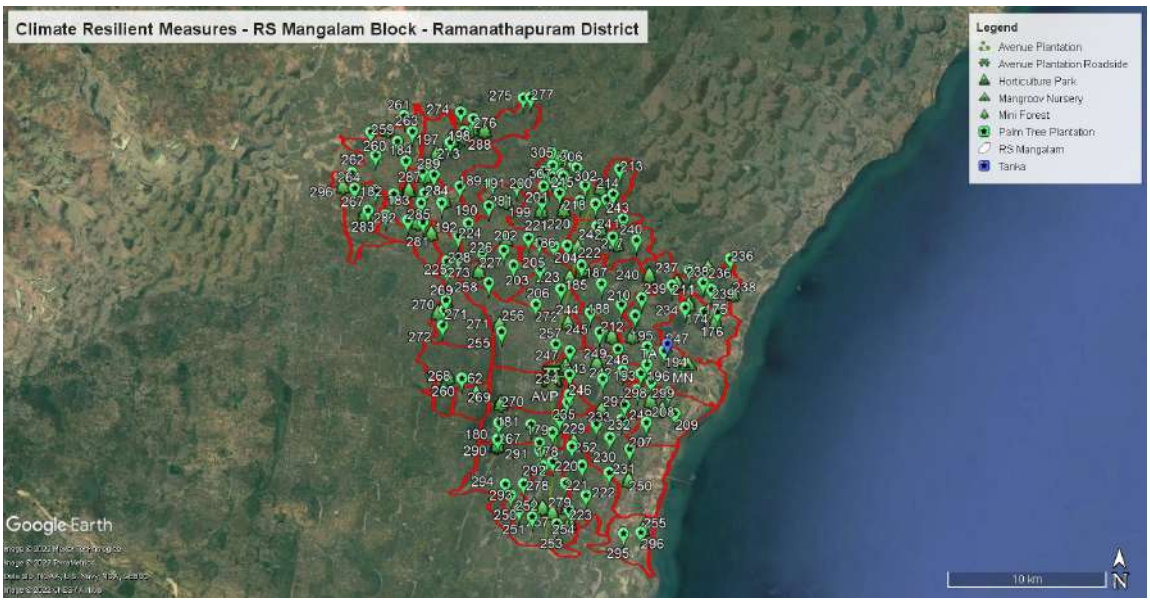


Figure 5.7. Proposed climate resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Agriculture and allied activities	Public and common land	Rural infrastructure
A. Manakkudi	Avenue planation	GP level nursery	
	Mini forest		
A. R. Mangalam	Mini forest	GP level nursery	Tankas
Aananthoor		GP level nursery	
Aayingudi		GP level nursery	
Alagardevankottai	Cascade Of Tanks	GP level nursery	Tankas
	Mega forest		
	Mini forest		
Anandur	Mini forest		Tankas
Ayingudi	Mega forest		Tankas
	Mini forest		
Chithoorvadi	Avenue planation	Block level nursery	Tankas
	Mini forest	GP level nursery	
Govindamangalam	Cascade Of Tanks	Horticulture	Tankas
	Mega forest	GP level nursery	
	Mini forest		
Gudaloor	Mini forest	GP level nursery	Tankas
Kadaloor	Avenue planation	GP level nursery	Tankas
	Mini forest		
Kallikkudi	Mega forest	GP level nursery	Tankas
	Mini forest		
Karkathakudi	Mini forest	GP level nursery	Tankas
Karungudi	Mini forest	GP level nursery	Tankas
Kavanakkottai	Mini forest	GP level nursery	Tankas
	Cascade Of Tanks		
Kavanoor	Avenue planation	GP level nursery	Tankas
	Mini forest		
Kothidal Kalakudi	Mini forest	GP level nursery	Tankas
Kottakudi	Mini forest	GP level nursery	Tankas
Melpanaiyur	Mini forest	GP level nursery	Tankas
Odaikkaal	Mini forest	GP level nursery	Tankas
Paaranur	Mini forest	GP level nursery	Tankas
Pichangurichi	Mini forest	GP level nursery	Tankas
	Mega forest		
Pullamadai	Cascade Of Tanks	GP level nursery	Tankas
	Mini forest		
R S Mangalam	Cascade Of Tanks		
Radhanur	Mega forest	GP level nursery	Tankas
	Mini forest		
Sanaveli	Mini forest	GP level nursery	Tankas
Sathanur	Mini forest	GP level nursery	Tankas
	Mega forest		
Sengudi	Cascade Of Tanks	GP level nursery	Tankas

Sengudi	Mini forest	GP level nursery	Tankas
Sethidal	Cascade Of Tanks	GP level nursery	Tankas
	Mini forest		
Sevvai Pattai, Govind-hamangalam	Cascade Of Tanks		
Sevvaipettai	Mega forest	GP level nursery	Tankas
	Mini forest		
Sholandur	Mini forest	GP level nursery	Tankas
Sirunagudi	Mini forest	GP level nursery	Tankas
Sirunakudi,Sethidal	Cascade Of Tanks		
Thiruppalaikkudi	Mini forest	GP level nursery	
Thiruthervalai	Cascade Of Tanks	GP level nursery	Tankas
	Mini forest		
Thumbadaikakottai	Avenue planation	GP level nursery	Tankas
	Cascade Of Tanks		
	Mega forest		
	Mini forest		
Uranagudi	Mini forest	GP level nursery	Tankas
	Mini forest		
Vadakkaloor	Mega forest	GP level nursery	Tankas
Varavani	Cascade Of Tanks	GP level nursery	Tankas

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	49	49	33	33

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
Govindhamangalam	0.16	850	**Govt./ Puram-pokku land**

TABLE 17. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (in ha)	No. of Plants (1 ha – 10,000 saplings)	Classification of land
Alagarthevankottai	0.5 ha in each GP	5,000 in each GP	**Govt. Purampokku land**
Ayinkudi			
Govindhamangalam			
Kallikudi			
Pichangurichi			
Rathaanur			
Sattanur			
Sevvaipettai			
Thumbadaikkakottai			
Vadakkalur			
Total	**5**	**50,000**	

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		
A.Manakudi	5.42	542	1,084	1,631	Govt Puram-pokku land
Chithoorvadi	3.52	352	704	1,060	
Kadaloor	7.54	754	1,508	3,865	
Tiruppalaikkudi	4.74	474	948	1,427	
Total	**21.22**	**2,122**	**4,244**	**1,427**	

TABLE 19. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (In ha)	Total No. of Plants (1 ha - 10000 saplings)	Classification of land
A.Manakudi	0.1	1,000	Govt Purampokku land
A.R.Mangalam	0.15	1,500	
Alagardevankottai	0.1	1,000	
Anandur	0.1	1,000	
Ayinkudi	0.15	1,500	
Chithurvadi	0.1	1,000	
Govinthamangalam	0.2	2,000	
Gudalur	0.1	1,000	
Kadalur	0.05	500	
Kallikudi	0.15	1,500	
Karkathakudi	0.15	1,500	
Karunkudi	0.1	1,000	
Kavanakottai	0.1	1,000	
Kavanur	0.1	1,000	
Kothidal Kalakudi	0.1	1,000	
Kottakudi	0.15	1,500	
Melpanaiyur	0.1	1,000	
Odaikkal	0.05	500	
Paaranur	0.1	1,000	
Pichankurichi	0.15	1,500	
Pullamadai	0.1	1,000	
Radhanur	0.15	1,500	
Sanaveli	0.1	1,000	
Sathanur	0.15	1,500	
Sengudi	0.05	500	
Sethidal	0.1	1,000	
Sevvaipettai	0.15	1,500	
Sholandur	0.1	1,000	
Sirunakudi	0.15	1,500	
Thiruppalaikudi	0.15	1,500	
Thiruthervalai	0.1	1,000	
Thumbadaikakottai	0.1	1,000	

Uranankudi	0.05	500	Govt Purampokku land
Vadakkalur	0.15	1,500	
Total	**3.9**	**39,000**	

TABLE 20. DETAILS OF PROPOSED TANKAS ACTIVITY UNDER CRM

Sl. No.	GP
1	Chithoorvadi
2	Alagarthevankkottai
3	Anandur
4	Ar Mangalam
5	Ayingudi
6	Chithoorvadi
7	Govindamangalam
8	Gudalur
9	Kadaloor
10	Kallikudi_2
11	Karkathakudi
12	Karungudi
13	Kavanakkottai
14	Kavanoor
15	Kothidal_Kalakkudi
16	Kottakudi_2
17	Melpanaiyur
18	Odaikkal

Sl. No.	GP
19	Paranur
20	Pitchangurichi
21	Pullamadai
22	Sanaveli
23	Sengudi
24	Sethidal
25	Sevvaipettai
26	Sholandur
27	Sirunakudi
28	Thiruthervalai
29	Thumbadakkakottai
30	Tiruppalaikkudi
31	Uranagudi
32	Vadakkaloor
33	Varavani
34	Radhanur
35	Sathanur

TABLE 21. DETAILS OF PROPOSED BLOCK LEVEL NURSERY DEVELOPMENT ACTIVITY UNDER CRM

GP	Area for Plantation (in ha)	No. of Plants (1 ha – 10,000 saplings)	Land type
Chithoorvadi	2.023	30,000	**Govt. Land**

TABLE 22. DETAILS OF PROPOSED GP LEVEL NURSERY DEVELOPMENT ACTIVITY UNDER CRM

GP	Total No. of Plants
A. Manakkudi	1,000 plants in each GP
Aananthoor	
Aayingudi	
Alagarthevankottai	
Chitthoorvadi	
Govindamangalam	
Gudaloor	
Kadalur	

Kallikkudi	1,000 plants in each GP
Karkatthakudi	
Karungudi	
Kavanakkottai	
Kavanoor	
Kothidal_Kalakkudi	
Kottakudi	
Melpanaiyur	
Odaikkaal	
Paaranur	
Pichangurichi	
Pullamadai	
Rathaanur	
Sanaveli	
Satthanur	
Sengudi	
Sethidal	
Sevvaipettai	
Sholandur	
Sirunagudi	
Thiruppalaikkudi	
Thirutthervalai	
Thumbadaikkakottai	
Uranangudi	
Vadakkalur	
Varavani	
Total	**35,000**

TABLE 23. DETAILS OF PROPOSED CASCADE OF TANKS DEVELOPMENT ACTIVITY UNDER CRM

Sl. No.	GP
1	Sevvai Pattai, Govindhamangalam
2	Govindhamangalam
3	Thiruthervalai
4	Sirunakudi,Sethidal
5	Kavanakottai
6	Pullamadai
7	Sethidal
8	Varavani
9	R S Mangalam
10	Sengudi
11	Alagarthevankottai
12	Thumbadakottai

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	4,352.82 ha (11.56 %) of the total area treated under WASCA
2	Percentage reduction of run off	668.70 ha.m i.e. 14 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	635 waterbodies (tanks/pond and ooranis) restored
4	Area under afforestation	759 ha area under afforestation
5	Length of drainage line treated	76.3 km length of drainage line treated
6	Canal Bund Plantation	More than 52 thousand plants through 262 works
7	Nursery development	514 units

4,352.82 ha
AREA TREATED

668.70 ha.m
TOTAL RUNOFF HARVESTED

635
WATER BODIES RESTORED

759 ha
AREA AFFORESTATION

76.3 km
DRAINAGE LINE TREATED

52,000
PLANTS

514 UNITS
NURSERY DEVELOPMENT

COASTAL WATERSHED WORKS

	INDICATOR		OUTCOMES/ IMPACT
1	Wetland Inlet improvement works	1	81
2	Bund plantation in west land	2	5,294 plants

81
WETLAND INLET WORK

5,294
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	822 farm ponds established which target the harvest of 14,46,720 cu.m of water which has the potential to irrigate 287.7 ha area
2	Improvement in soil health	2	270 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	3	1,500 ha under dry land horticulture
4	Households established fodder plots	4	2,689 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	5	1,103

822
FARM PONDS

270
COMPOST UNITS

2,689
FODDER PLOTS

1,500 ha
DRY LAND HORTICULTURE

1,103
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	2,057 individual and 204 community level soak pits established for recycle of grey water benefiting 21,288 HHs
2	Roof rain water harvesting measures	70 common roof rainwater harvesting and storage structures with a target to harvest and store 0.1 ha.m of rainwater for use
3	Nutri-garden	21,288 HHs established nutri-gardens in homesteads and planted 1,06,140 saplings

204 COMMON & **2,057** INDIVIDUAL SOAK PITS

70 COMMON ROOF RAINWATER HARVESTING

21,288 NUTRI-GARDENS

1,06,140 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	1	8 models are identified via., farm ponds, horticulture park, avenue plantation, mini forest, mega forest, tankas, Block and GP level nursery development and Cascade of Tanks 153 farm ponds Horticulture Park in 0.16 ha. Mega forest in 5 ha area with 50,000 plants Avenue plantation along the road of length 21.22 km with 1,427 plants Mini forest in 3.9 ha with 39,000 plants Tankas in 35 GPs Block level Nursery in 2.023 ha area 35 GP Nursery development sites 12 Cascade of Tanks

153 FARM PONDS

21.22 km AVENUE PLANTATION

3.9 ha MINI FOREST

35 GP NURSERY

0.16 ha HORTICULTURE PARK

2.023 ha BLOCK LEVEL NURSERY

5 ha MEGA FOREST

35 TANKAS

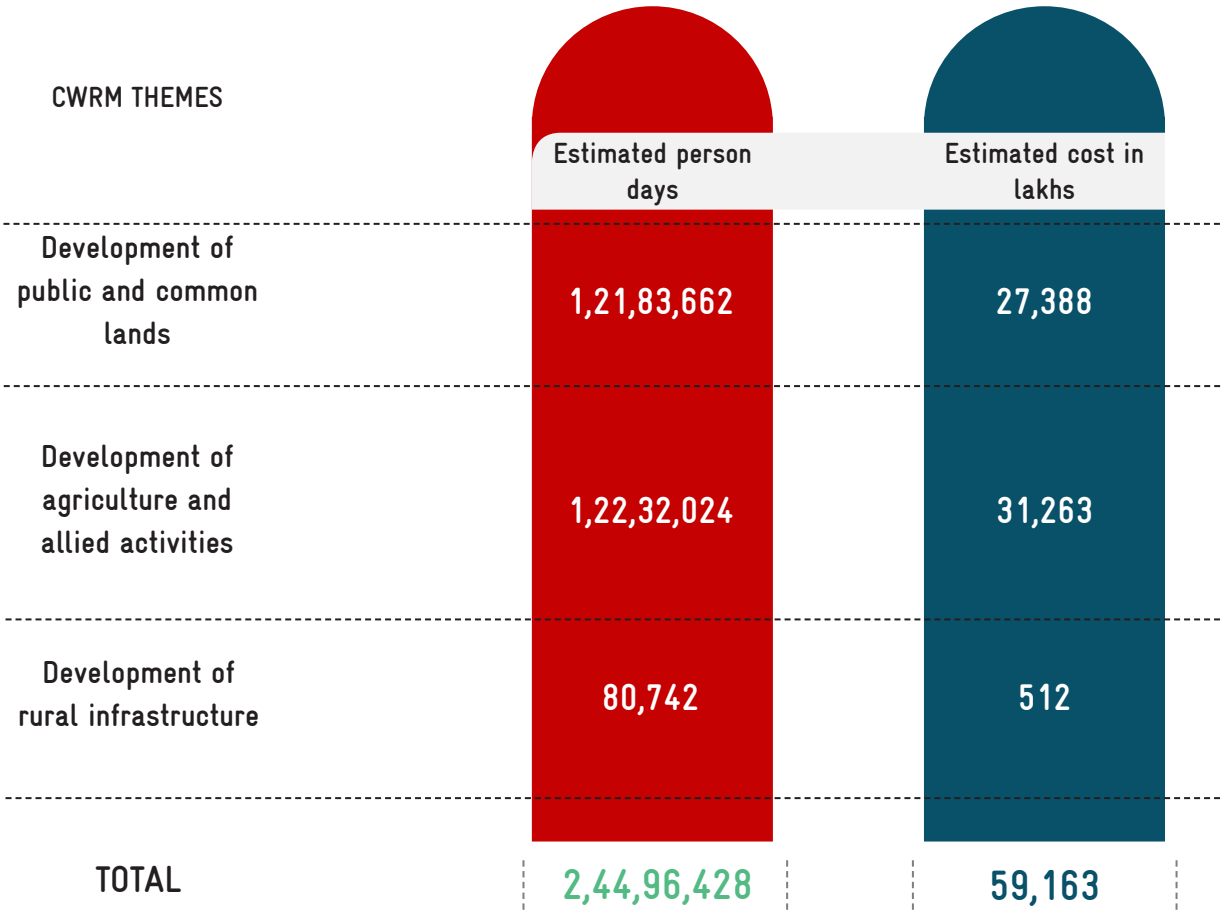
12 CASCADE OF TANKS

Estimated person days

The total estimated person days required for the above propose activities are 2,44,96,428 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above propose activities is Rs. 59,163 Lakhs as specified below in Figure 6.2.



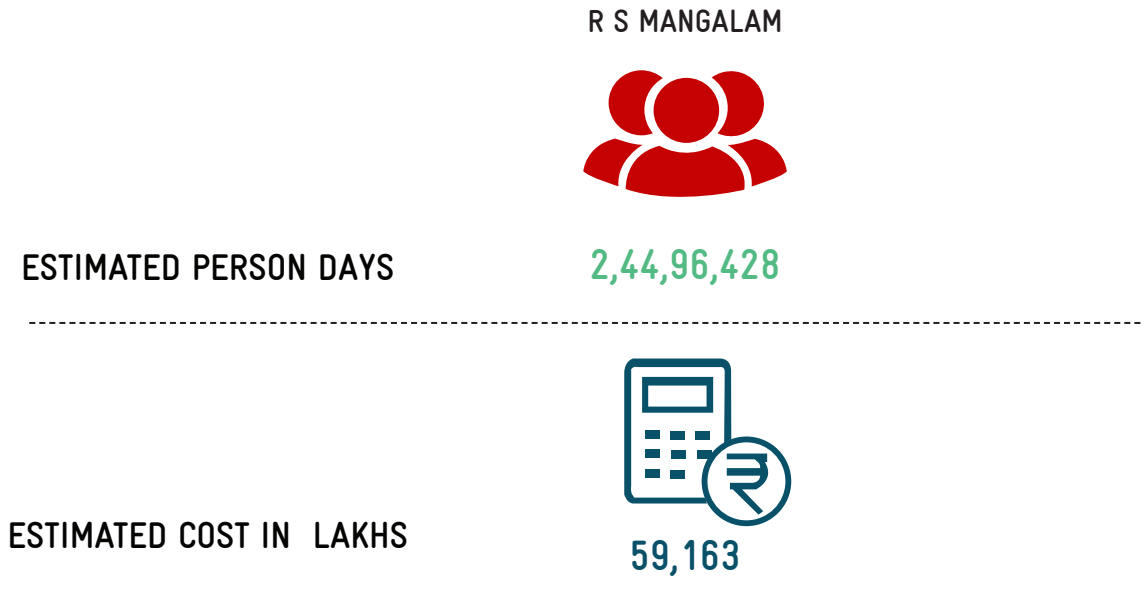


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

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.

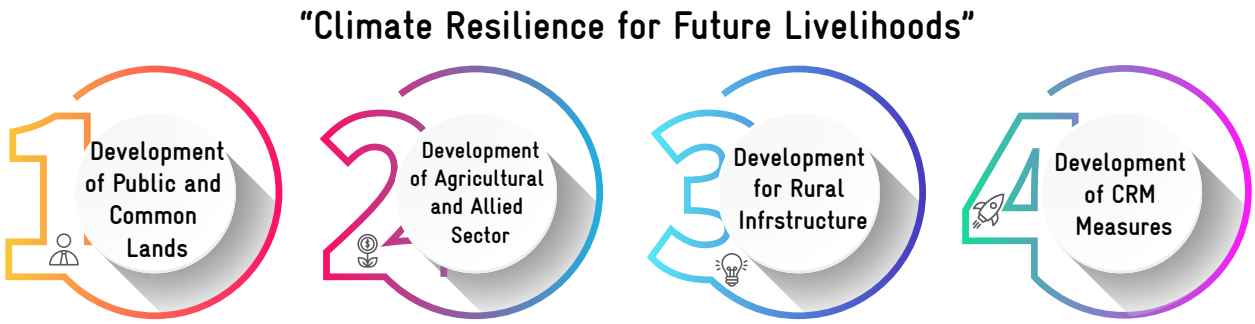
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national 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 24).

TABLE 24. 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 25 to 27.

TABLE 25. 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)	3,037	W3	SDG 1,2, 6,13&15
Composting (No. of units)	822	W1	SDG1& 6
Afforestation in Public/common lands (ha)	759	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	589	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	3	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	95	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	262	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	16,316	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	149	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	514	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies :PWD and Union Tanks (No.)	227	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	396	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	12	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	164	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	16,316	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	1,908	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)	529	W3,S2	SDG 1, 6, 13, 14, 15
Wetland plantation (inner)(ha)	13	W3,S2	SDG 1, 6, 13, 14, 15
Coastal wetland - Bund strengthening (km)	2,563	W3,S2	SDG 1, 6, 13, 14, 15
Wetland Inlet improvement works(No.)	81	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)	0	S2	SDG 1, 2, 6, 13

TABLE 26. 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)	3,005	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	378	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	822	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	1,027	W1,W5,A1,A3,S2,S4	SDG 2, 6& 15
Dry land Horticulture/Agro-forestry - Individual (ha)	1,500	A1,A3,A4,W1,S4,S2,C1	SDG 1,2 & 15
Azolla units - Individual (No. of units)	270	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	270	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	270	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	270	S4	SDG 1& 2

Goat/sheep shelters (No. of units)	270	S4	SDG 1& 2
Cattle trough(No. of units)	270	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	293	S2,S4	SDG 1& 2

TABLE 27. 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)	204	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	2,057	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	70	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

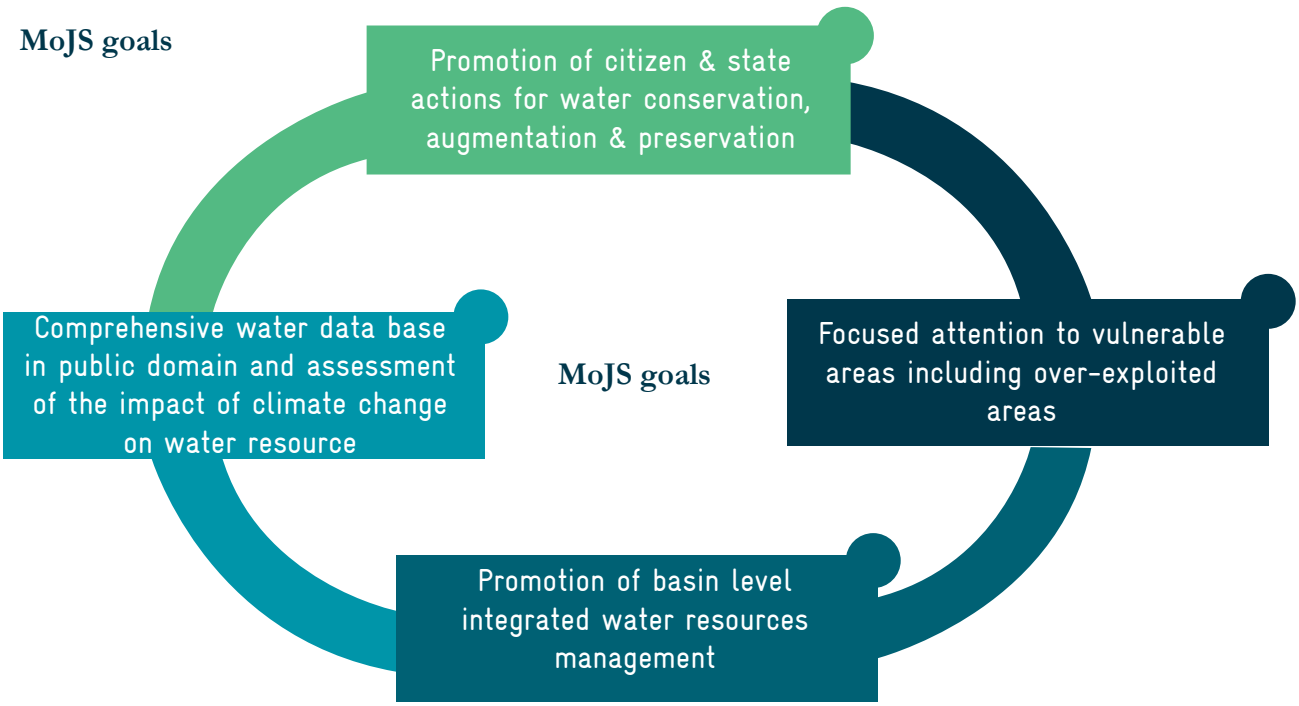
7 IMPLEMENTATION OF GP PLANS

Execution of GP plans includes integrating all verified, approved works in MORD's web enabled application NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identified first, the status of GIS based plans and total works along with its expenditure and category wise estimation 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 R S Mangalam Block is listed in Table 28 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 28. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN R S MANGALAM BLOCK



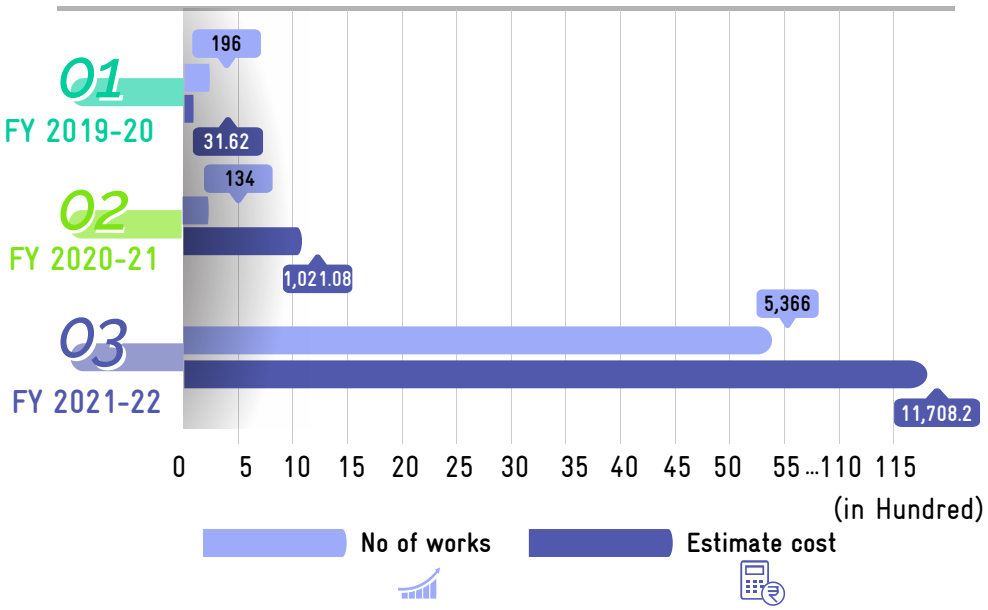


Figure 7.1. Work progress in last three years

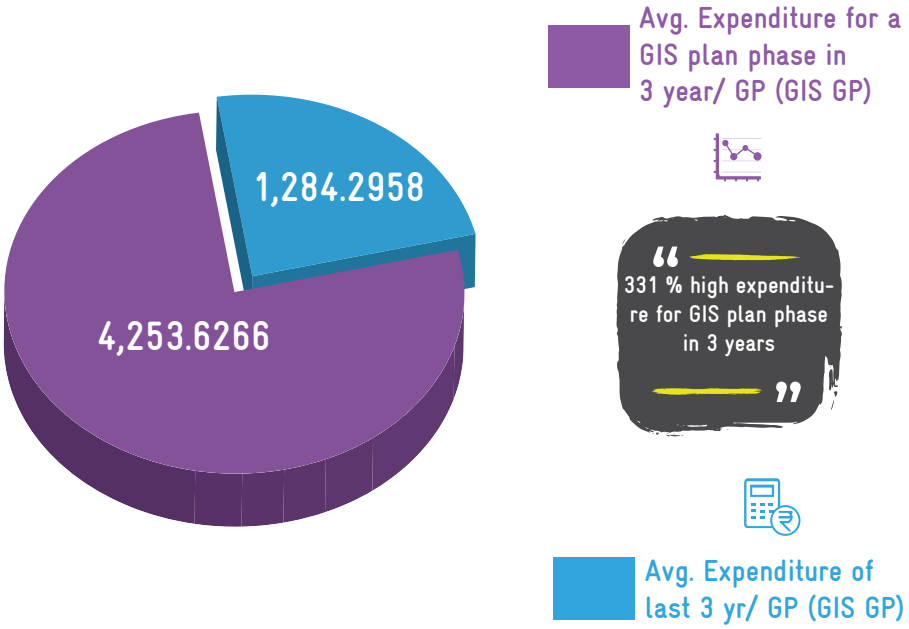
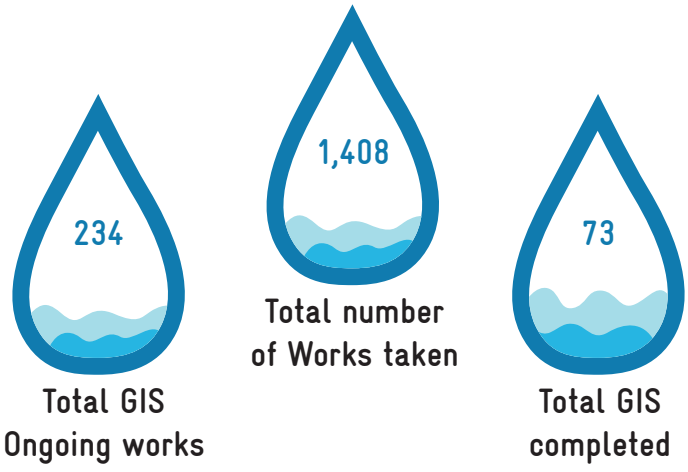


Figure 7.2. Average Expenditure for GIS plan in last 3 years



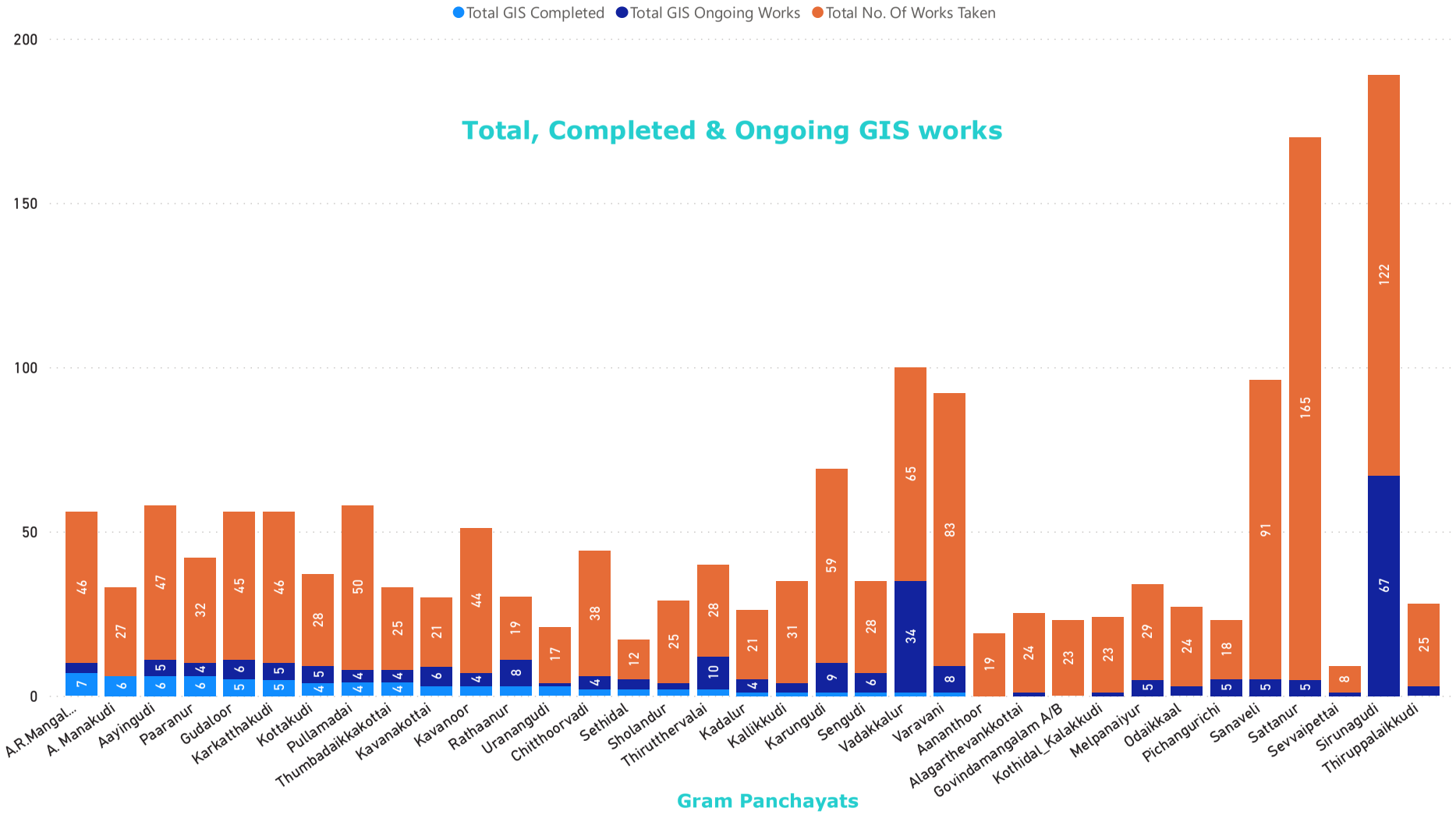
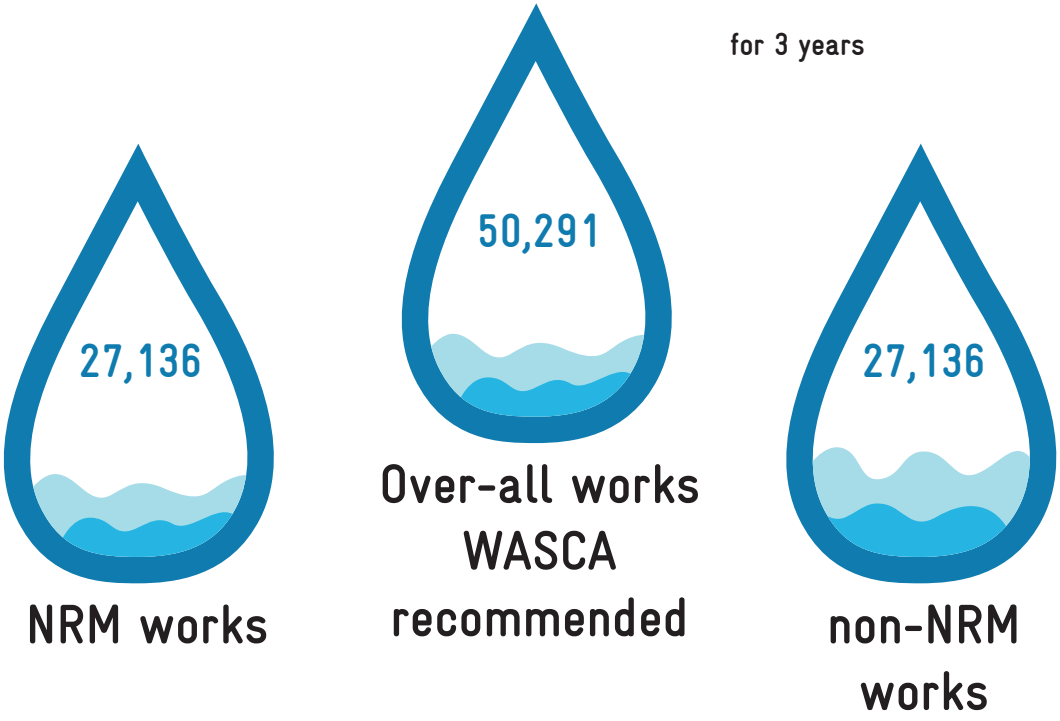


Figure 7.3. GP wise total, completed and ongoing GIS works (2021-22)

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 50,291 works for a period of 3 years, out of which 27,136 are NRM works and 23,155 are non NRM works (Figure 7.4). A total of 4,348 works has been uploaded so far for the financial year 2021-22 as on 23/02/2022.



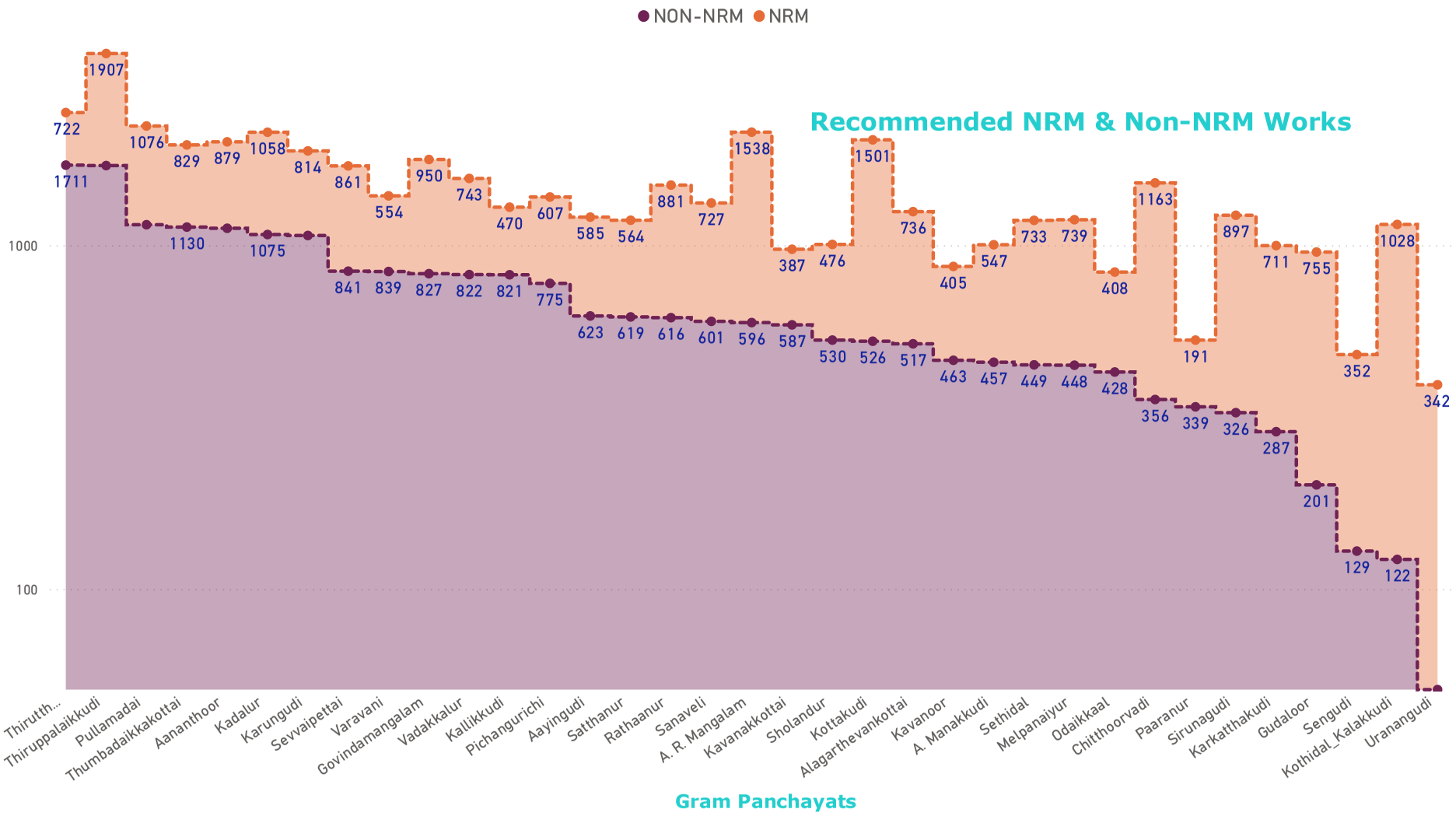


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in R S Mangalam Block includes Water Conservation and Water Harvesting, Works on Individuals Land (Category IV), Rural Connectivity, and Drought Proofing. A total of 133 works are ongoing in the Block, in which WCWH related work are more (48 %) followed by individual beneficiaries works (38 %) while rural infrastructure works are less in numbers (Figure 7.5), GP and work category wise ongoing works are tabulated in Annexure 7.2.

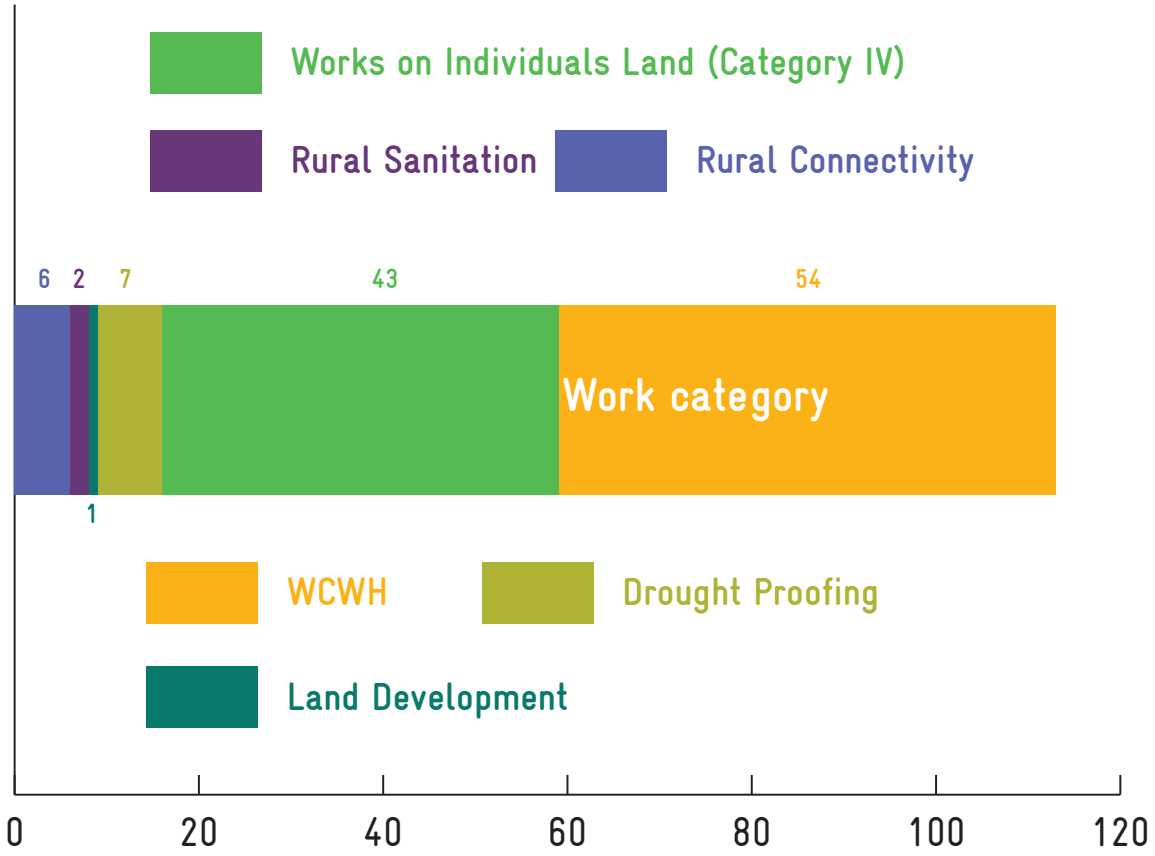


Figure 7.5. Category-wise ongoing works in R S Mangalam Block

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 R S Mangalam Block is Rs. 1,764.09 Lakhs and nearly 76 % of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

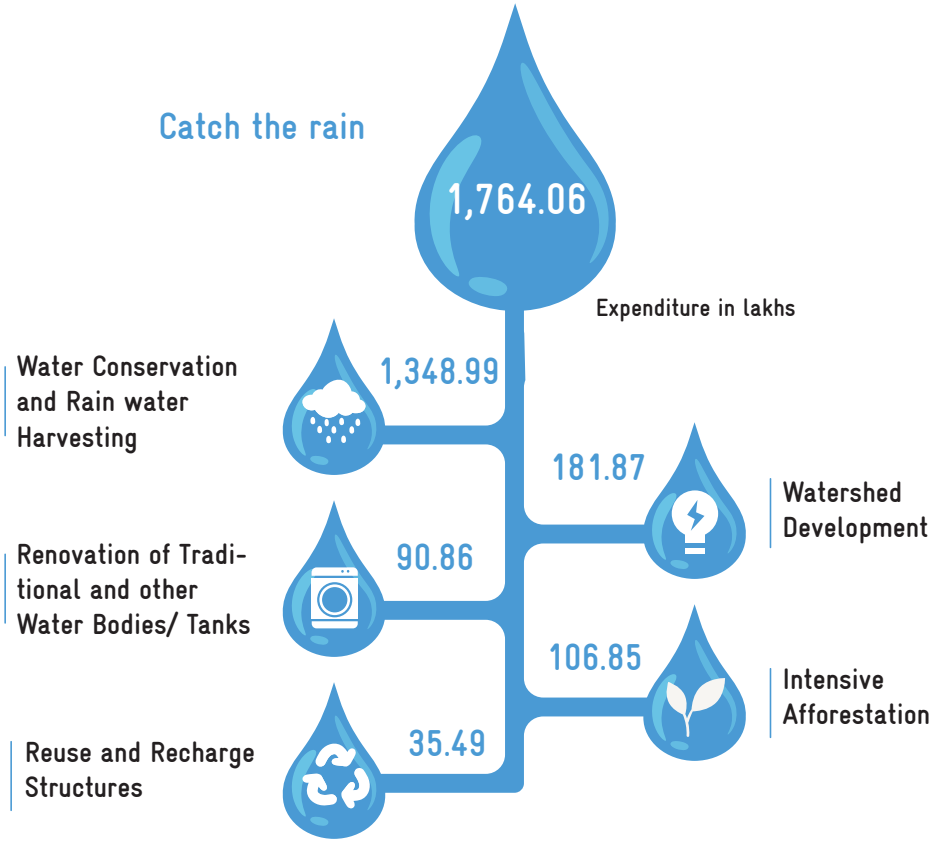
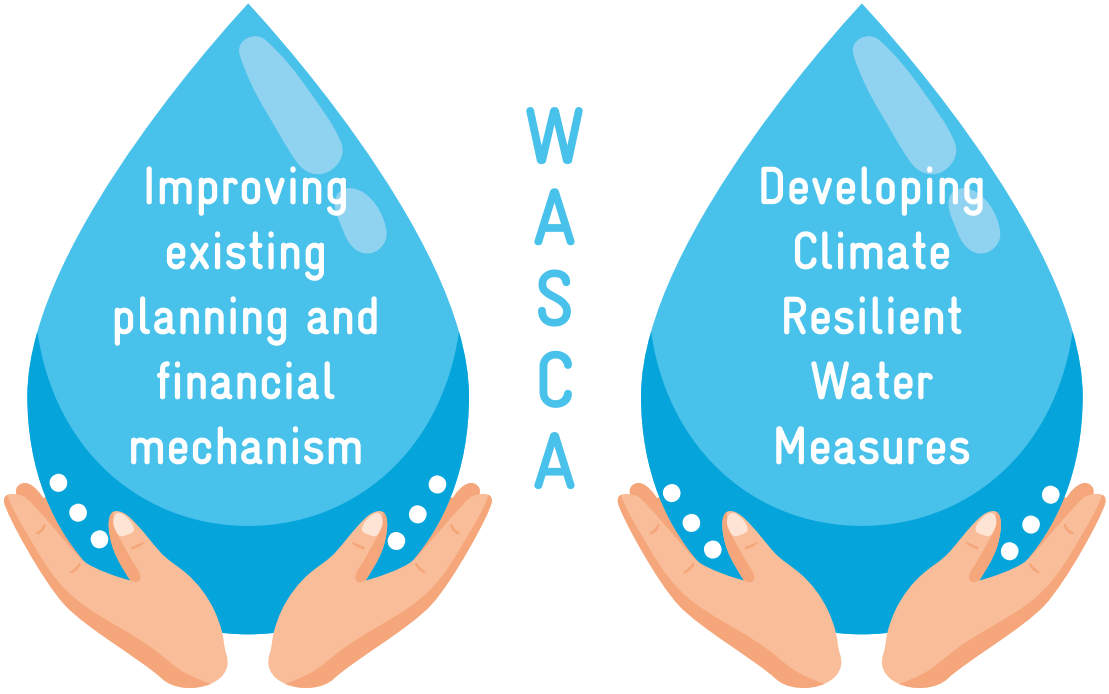


Figure 7.6. Expenditure for Catch the Rain campaign in R S Mangalam Block



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

R S Mangalam Block comes under Kottakkaraiyar sub-basin of Pambar Kottakkaraiyar basin. Kottakkaraiyar and Sarugani Rivers flow through the Block. Lower Vaigai (4) and Kottakkaraiyar macro- watersheds covers the Block. Kottakkaraiyar watershed (4A2B1) has 84 Micro-watersheds covering an area of 42755.03 ha. (Figure 8.1) and (Table 29). Lower Vaigai (4) watershed (4A2A1) has 10 micro-watersheds covering an area of 5902.67 ha. Out of 35 GPs of R S Mangalam Block, 33 GPs fall under Kottakkaraiyar micro-watershed and 2 GPs fall under Lower Vaigai (4) micro-watershed. (Table 30). The micro-watershed related works are identified using Basin, Sub-basin, and micro-watershed with GP administrative boundaries through CWRM approach.

TABLE 29. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING R S MANGALAM BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Kottakkaraiyar	42755.03	84
Lower Vaigai (4)	5902.67	10

TABLE 30. NO. OF GPs COVERED UNDER WATERSHEDS IN R S MANGALAM BLOCK

Name of watershed	No. of GPs
Kottakkaraiyar	33
Lower Vaigai (4)	2

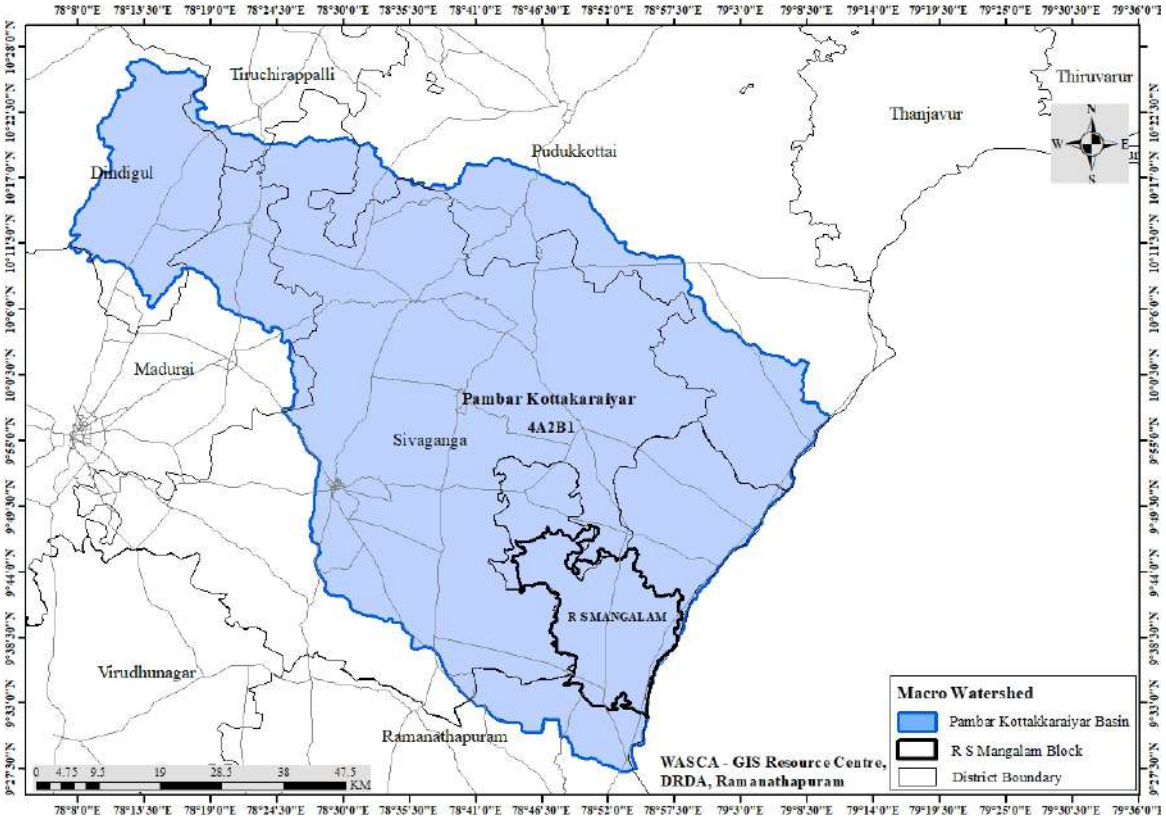


Figure 8.1. Macro-watershed map - R S Mangalam Block

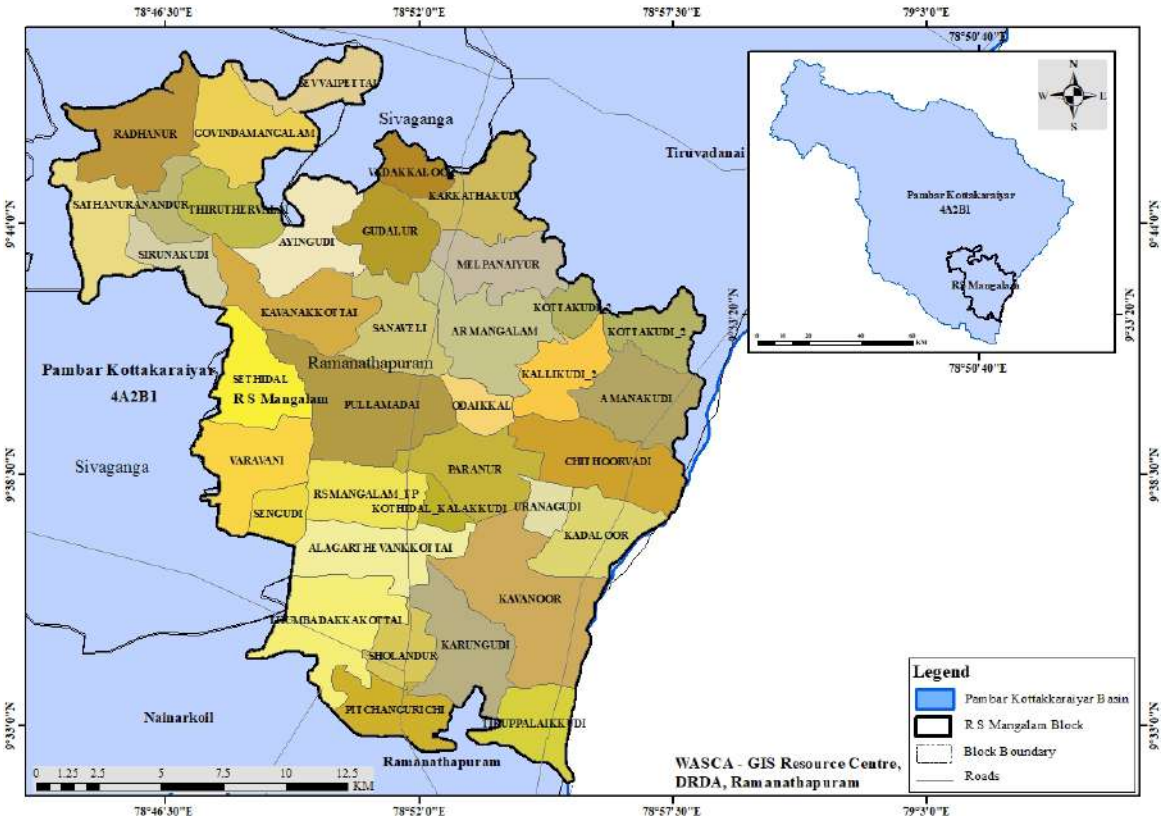


Figure 8.2. Macro-watershed with GPs

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 R S Mangalam Block are listed in Tables 31 to 36.

TABLE 31. MICRO-WATERSHED IN R S MANGALAM BLOCK FALLING UNDER KOTTAKKARAIYAR MACRO-WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2B1d04c	2.545590078	Lower
2	4A2B1d02d	36.47899304	
3	4A2B1d01e	1.068282491	
4	4A2B1d05d	63.90582883	
5	4A2B1d05c	294.4988323	
6	4A2B1d07c	230.7000575	
7	4A2B1d12a	136.945713	
8	4A2B1d06b	250.0265449	
9	4A2B1d01d	333.2970011	
10	4A2B1d04a	280.4666807	
11	4A2B1d07b	6.362847118	
12	4A2B1d02c	462.3125809	
13	4A2B1d13a	214.3592656	
14	4A2B1d05b	134.5249578	
15	4A2B1b08c	480.5424094	
16	4A2B1d01c	629.9789734	
17	4A2B1d06c	12.73792331	
18	4A2B1d04b	361.584509	
19	4A2B1c07b	78.58144095	
20	4A2B1d07a	260.1427208	
21	4A2B1b08b	544.6274513	
22	4A2B1d01b	445.0823732	
23	4A2B1d02b	549.8953182	
24	4A2B1b07b	663.5812566	
25	4A2B1d03c	114.3033004	
26	4A2B1d05a	493.1259155	
27	4A2B1b07d	749.2702223	
28	4A2B1c06c	643.2314268	
29	4A2B1b06c	930.9845076	
30	4A2B1c07a	338.7219841	
31	4A2B1d03b	472.5704306	
32	4A2B1b07c	324.2461201	
33	4A2B1d03a	592.9874835	
34	4A2B1d02a	679.0262727	
35	4A2B1d01a	647.6698227	
36	4A2B1b05c	601.7677098	
37	4A2B1b04c	983.7519102	
38	4A2B1b06d	599.6653593	

39	4A2B1b06e	382.5082582	
40	4A2B1b04b	1032.071471	
41	4A2B1c06b	114.0111603	
42	4A2B1c06a	288.4082716	
43	4A2B1b04a	493.6335029	
44	4A2B1c08a	31.4798749	
45	4A2B1b03d	336.5204991	
46	4A2B1b05a	733.7647046	
47	4A2B1b03a	1209.5158	
48	4A2B1b05d	484.7404274	
49	4A2B1c01b	574.1083484	
50	4A2B1b02d	989.3418861	
51	4A2B1b02c	430.9803464	
52	4A2B1b03b	530.9787561	
53	4A2B1b03c	463.7740224	
54	4A2B1c05a	71.03894611	
55	4A2B1b02b	877.8797301	
56	4A2B1b01b	784.5982992	
57	4A2B1a03b	745.2525871	
58	4A2B1b02a	630.1911717	
59	4A2B1c01a	1515.884076	
60	4A2B1a03a	906.2679728	
61	4A2B1b01c	742.4989685	Lower
62	4A2B1c05b	134.151458	
63	4A2B1b01a	919.5771373	
64	4A2B1c04a	464.2792651	
65	4A2B1a01d	407.1566893	
66	4A2B1a02a	268.5996042	
67	4A2B1a01c	273.538997	
68	4A2B1a02b	778.8630975	
69	4A2B1a02c	955.5542722	
70	4A2B1a05a	507.0236348	
71	4A2B1a01b	558.7307756	
72	4A2B1a01a	460.6355915	
73	4A2B1c02a	1440.795165	
74	4A2B1a05b	460.1509508	
75	4A2B1a05c	426.8349864	
76	4A2B1a07c	991.1203115	
77	4A2B1a07b	526.801441	
78	4A2B1a04c	295.245098	
79	4A2B1a07a	739.7014802	
80	4A2B1a04a	517.3175424	
81	4A2B1a06b	1076.247953	
82	4A2B1a04d	331.014779	
83	4A2B1a04b	396.138945	
84	4A2B1a06a	810.5260665	

TABLE 32. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER KOTTAKKARAIYAR MACRO-WATERSHED IN R S MANGALAM BLOCK

Sl.No	Name of the GP	Ridge Type
1	Anandur	Lower
2	Aayingudi	
3	Alagarthevankottai	
4	A. Manakkudi	
5	A. R. Mangalam	
6	Chitthoorvadi	
7	Govindamangalam	
8	Gudaloor	
9	Kadalur	
10	Kallikkudi	
11	Karkathakudi	
12	Karungudi	
13	Kavanakkottai	
14	Kavanoor	
15	Kothidal Kalakkudi	
16	Kottakudi	
17	Melpanaiyur	
18	Odaikkaal	
19	Paaranur	
20	Pullamadai	
21	Radhanur	
22	Sanaveli	
23	Sathanur	
24	Sengudi	
25	Sethidal	
26	Sevvaipettai	
27	Sholandur	
28	Sirunagudi	
29	Thiruthervalai	
30	Thumbadaikkakottai	
31	Uranangudi	
32	Vadakkalur	
33	Varavani	

TABLE 33. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER KOTTAKKARAIYAR MACRO-WATERSHED IN R S MANGALAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	7,121
2	Afforestation in Public/common lands (ha)		712.09
3	Drainage Line Treatment (m)		70,274
4	Block Plantation (Community) (ha)		578.76
5	Avenue plantation (km)		1,443

6	Composting (No.)	Lower	796
7	Canal Bund Plantation (km)		57.2
8	Restoration of water bodies: Tanks and Ooranis (No.)		568
9	Artificial Recharge Structure (No.)		762
10	Farm Bunding with Boundary Trenches - Individual (ha)		2,915.52
11	Construction of Farm Ponds - Individual (No.)		796
12	Land development - Individual (ha)		995.73
13	Azolla units - Individual (No.)		242
14	NADEP Vermi compost (No.)		242
15	Fodder development - Community & Individual (No.)		242
16	Cattle Shelters (No.)		242
17	Goat Sheep Shelters (No.)		783
18	Cattle Trough (No.)		242
19	Soak Pits (Community) (No.)		181
20	Soak Pits (Individual) (No.)		1,828
21	Roof Rain Water Harvesting (No.)		66
22	Agro Forestry (ha)		712
23	Nutri Garden (No.)		33
24	Silt application (No.)		399
25	Mini Forest (ha)		74
26	Fish Drying Yard (No.)		11
27	Bird Watching Tower (No.)		3
28	Fish Processing Unit (No.)		9
30	Wetland Bund Strengthening (km)		129
31	Wetland Bund Plantation (No.)		26
32	Wetland Inlet (No.)		3

TABLE 34. MICRO-WATERSHED IN R S MANGALAM BLOCK FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2A1e02a	688.4960873	Lower
2	4A2A1e05c	332.4100251	
3	4A2A1e08a	1199.521569	
4	4A2A1e05b	545.7042197	
5	4A2A1e02d	615.409724	
6	4A2A1e02b	567.8469981	
7	4A2A1e02c	295.3435708	
8	4A2A1e03a	735.2685016	
9	4A2A1e03b	521.7103151	
10	4A2A1e01e	400.9573006	

TABLE 35. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN R S MANGALAM BLOCK

Sl.No	Name of the GP	Ridge Type
1	Pichankurichi	Lower
2	Thiruppalaikkudi	

TABLE 36. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN R S MANGALAM BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	471.3
2	Afforestation in Public/common lands (ha)		47.13
3	Drainage Line Treatment (m)		6,036
4	Block Plantation (Community) (ha)		10.2
5	Avenue plantation (km)		48.3
6	Composting (No.)		26
7	Restoration of water bodies: Tanks and Ooranis (No.)		16
8	Artificial Recharge Structure (No.)		8
9	Farm Bunding with Boundary Trenches - Individual (ha)		36
10	Construction of Farm Ponds - Individual (No.)		26
11	Land development - Individual (ha)		13
12	Azolla units - Individual (No.)		23
13	NADEP Vermi compost (No.)		23
14	Fodder development - Community & Individual (No.)		23
15	Cattle Shelters (No.)		23
16	Goat Sheep Shelters (No.)		29
17	Cattle Trough (No.)		23
18	Soak Pits (Community) (No.)		23
19	Soak Pits (Individual) (No.)		229
20	Roof Rain Water Harvesting (No.)		4
21	Nutri Garden (No.)		2
22	Silt application (No.)		13
23	Mini Forest (ha)		6

8.2 MODEL MICRO-WATERSHED- UPPUR CHATHIRAM

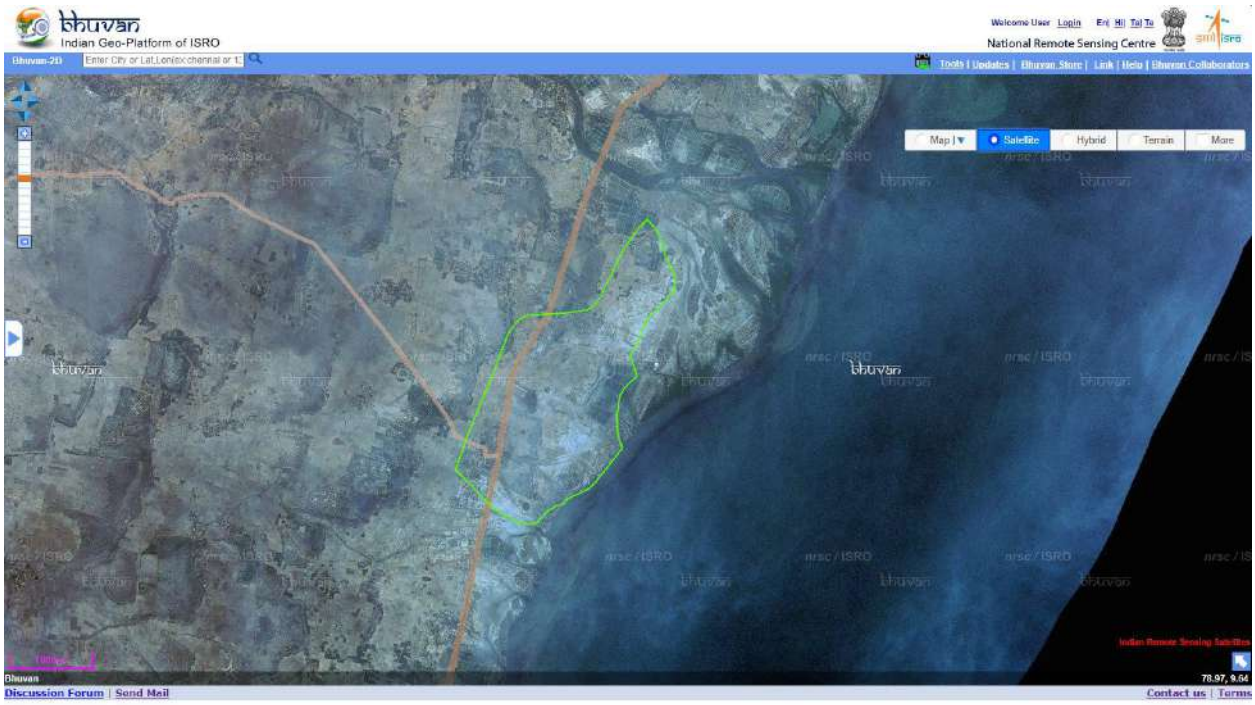


Figure 8.3. Satellite image of Uppur Chathiram micro-watershed

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.

UPPUR CHATHIRAM MICRO-WATERSHED

Uppur Chathiram micro-watershed falls under Kadalur and Chithoorvadi GPs, in R S Mangalam Block, Ramanathapuram District. The satellite image of the micro-watershed is shown in Figure 8.3. This micro-watershed is the part of Kottakkaraiyar macro-watershed in Kottakkaraiyar sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of Uppur Chathiram 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 37 to 49 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is given in Annexure 8.

TABLE 37. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Uppur Chathiram Micro-watershed
Micro-watershed Number	4A2B1a01a
Name of the Basin	Pambar Kottakkaraiyar Basin
Name of the sub basin	Kottakkaraiyar Sub basin
Name of the Macro-watershed	Kottakkaraiyar Macro-watershed
Number of GPs covered under the Micro-watershed	2
Name of the GPs	1. Kadalur
	2. Chithoorvadi
Latitude of Micro-watershed (From To)	9°36'22.609"N to 9°38'28.312"N
Longitude of Micro-watershed (From To)	78°55'21.17"E to 78°56'53.77"E
Total area of the Micro-watershed in ha	460.64
% of Micro-watershed area in Kadalur GP	88
% of Micro-watershed area in Chithoorvadi GP	12
Area of Micro-watershed falling in Kadalur GP (ha)	406.14
Area of Micro-watershed falling in Chithoorvadi GP (ha)	55
Length of the Coastal Line on Kadalur GP (m)	3,498
Length of the Coastal Line on Chithoorvadi GP (m)	2,125
Total Population of Kadalur GP	4,043
Total Population of Chithoorvadi GP	1,952
Annual Average Rainfall (mm)	821 mm
Annual maximum Temperature (°C)	32.6
Annual Minimum Temperature (°C)	23.8
Evapo-Transpiration Losses of Kadalur GP (ha.m)	18.39
Evapo-Transpiration Losses of Chithoorvadi GP (ha.m)	25.70
Volumetric soil moisture availability (%)	23
Climate Risk	Drought and Coastal inundation
CVI Index Value for Kadalur (Based on WASCA Climate study)	0.507 (High Agriculture Vulnerability)
CVI Index Value for Chithoorvadi (Based on WASCA Climate study)	0.551 (High Agriculture 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 Kadalur GP	Safe
Status of Ground water in Chithoorvadir GP	Safe

TABLE 38. HYDROGEOLOGY & OTHER CHARACTERISTICS IN MICRO-WATERSHED

Type of Geomorphology	Coastal Origin - Younger Coastal Plain
Geomorphology occurrence in %	58
Principle Aquifer	Alluvium
Salt Affected Area passing through the micro-watershed	85.4 ha (Lower Ridge)
Type of lineaments passing through the micro-watershed	None
Barren & waste lands	24.92 ha (Lower Ridge)

TABLE 39. EXISTING WATER HARVESTING STRUCTURES IN KADALUR & CHITHOORVADI GPs

Sl.No.	Name of Structure	Kadalur GP		Chithoorvadi GP	
		Existing Structures		Existing Structures	
		No.	Area in ha	No.	Area in ha
1	Oorani	9	16.04	4	5.41
2	Tank	6	148.45	8	143.27
3	Farm Ponds	4	2	2	1
	Total	**10**	**166.49**	**10**	**149.68**

TABLE 40. CATCHMENT AREA OF MICRO-WATERSHED (STRANGE METHODOLOGY - CGWB)

Catchment Area in ha	Kadalur GP	Chithoorvadi GP
Good catchment area	539.64	210
Average catchment area	2.55	17
Bad catchment area	552.55	1,231

TABLE 41. GROUND WATER STATUS OF MICRO-WATERSHED

Name of the Firka (Assessment Unit) falling under micro-watershed	Sholandur
Recharge from other sources during monsoon season (ha.m)	2,056.18
Recharge from other sources during non-monsoon season (ha.m)	69.44

TABLE 42. SALINITY AND SEA WATER INTRUSION IN THE MICRO-WATERSHED

Pre monsoon Water Quality Index	Very Poor Quality
Post monsoon Water Quality Index	Medium Quality
Pre monsoon Sea Water Mixing Index	1-2
Post monsoon Sea Water Mixing Index	1-2

TABLE 43. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED-KADALUR & CHITHOORVADI GPs

Water Budget in ha.m	Kadalur GP	Chithoorvadi GP
Water for domestic	11.07	5.34
Water for agriculture	847.3	664.5
Water for livestock	1.48	1.57
Village wise water required	859.8	671.4
Available run-off from rain water (derived from Strange method)	182.9	189.3
Harvested Runoff from Water Harvesting Activities	14.4	14.2
Potential Harvesting from proposed Interventions	38.5	35.8
Total Water harvested	52.9	50.0
Water demand and Supply Difference	-806.9	-621.4
Water demand supply gap status	Deficient	Deficient
Per capita Water Availability in cum	130.84	256.15
International Standard per capita water Availability (cum)	1,700	1,700
Water Availability Gap (cum)	-1,569	-1443.85
Water security status	Water Stress	Water Stress

TABLE 44. GP WISE PROPOSED MICRO-WATERSHED WORKS – KADALUR & CHITHOORVADI GPs

Proposed Work	Kadalur GP	Chithoorvadi GP
Proposed works in Upper Ridge	0	0
Proposed works in Middle Ridge	0	0
Proposed works in Lower Ridge	145	162
Total works	145	162

TABLE 45. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED- KADALUR & CHITHOORVADI GPs

Ridge Type	Kadalur GP	Chithoorvadi GP
Lower Ridge		
Estimated cost for Lower Ridge area (INR in Lakhs)	142.37	28.25
Total area in ha of Lower Ridge	406.14	55
Estimated Person days generated for Treatment of Lower Ridge	**70,293**	**5,144**
Treatment cost of Lower Ridge Lakhs/ha	**0.351**	**0.514**

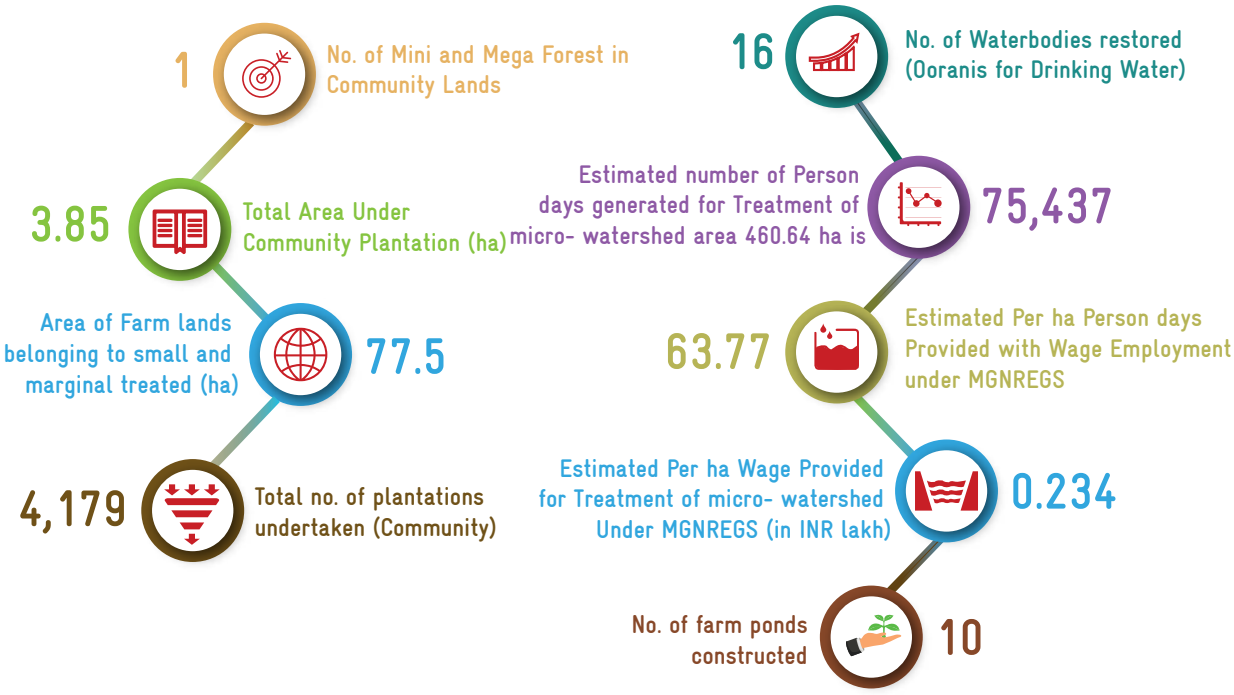
Kadalur GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.351 lakh/ha	70,293
	0.351 lakh/ha	70,293

Chithoorvadi GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	NA	NA
Lower Ridge	0.514 lakh/ha	5,144
	0.514 lakh/ha	5,144

TABLE 46. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	89
Total No. of works in Micro-watershed including livelihood Activities	53
Total No. of works in Micro-watershed including Rural Greywater Management Activities	20

TABLE 47. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Kadalur GP	57.11 lakh
Chithoorvadi GP	72.57 lakh

TABLE 48. ESTIMATES OF MICRO-WATERSHED IN KADALUR 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	15	15	12.3	44,807
Oorani bund Plantation (No.)			2,171	15	9.99	3,621
Avenue plantation (km)			2.95	2	2.71	978
Afforestation (ha)			1.53	1	3.17	1,144
Mini Forest (No.)		Completed	500	1	5.75	3,950
Roof Rain Water Harvesting in GP Building (No.)		Not commenced	25000 L	1	0.3	15
Sub total				**35**	**34.22**	**54,515**
Coastal Watershed Activities						
Watch Tower (No.)	Lower	Not commenced	1	1	0.1	733
Fish Drying Yard (No.)			2	2	6.19	108
Sub total				**3**	**6.29**	**841**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	10	10	2.7	120
Farm Bunding with Boundary Trenches - Individual (ha & No.)			7.5 3	3	11.25	1,758
Construction of Farm Ponds - Individual (No.)			7	7	12.6	4,340
Composting (No.)			6	6	0.54	186
NADEP Vermi compost (No.)			6	6	0.71	30
Fodder development - Individual (No.)			3	3	4.44	7,032
Sub total				**35**	**32.24**	**13,466**
Total				**73**	**72.75**	**68,822**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Fish Drying Yard (No.)	Lower	Not commenced	2	2	12.38	216
Azolla Production Unit (No.)			7	7	1.05	98
Cattle Shelters (No.)			11	11	17.6	363
Poultry Shed (No.)			11	11	22	242
Goat Sheep Shelters (No.)			11	11	12.65	330
Cattle Trough (No.)			11	11	2.2	121
Sub total				**53**	**67.88**	**1,370**

Rural Greywater and Roof Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	12	12	1.3	72
Soak Pits (Community) (No.)			3	3	0.39	24
Nutri Garden (No.)			5	5	0.05	5
Sub total				**20**	**1.74**	**101**
Total				**146**	**142.37**	**70,293**

TOTAL ESTIMATES OF MICRO-WATERSHED IN KADALUR GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Kadalur GP	146	142.37	70,293

TABLE 49. ESTIMATES OF MICRO-WATERSHED IN CHITHOORVADI 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	1	1	10	350
Oorani bund Plantation (No.)			167	1	0.77	281
Block Plantation (ha)			1.82	1	3.77	1,364
Sub total				**3**	**14.54**	**1,995**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	2	2	0.54	24
Farm Bunding with Boundary Trenches - Individual (ha &No.)			5 2	2	7.5	1,172
Construction of Farm Ponds - Individual (No.)			3	3	5.4	1,860
Composting (No.)			3	3	0.27	93
Sub total				**10**	**13.71**	**3,149**
Total				**13**	**28.25**	**5,144**

TOTAL ESTIMATES OF MICRO-WATERSHED IN CHITHOORVADI GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Chithoorvadi GP	13	28.25	5,144

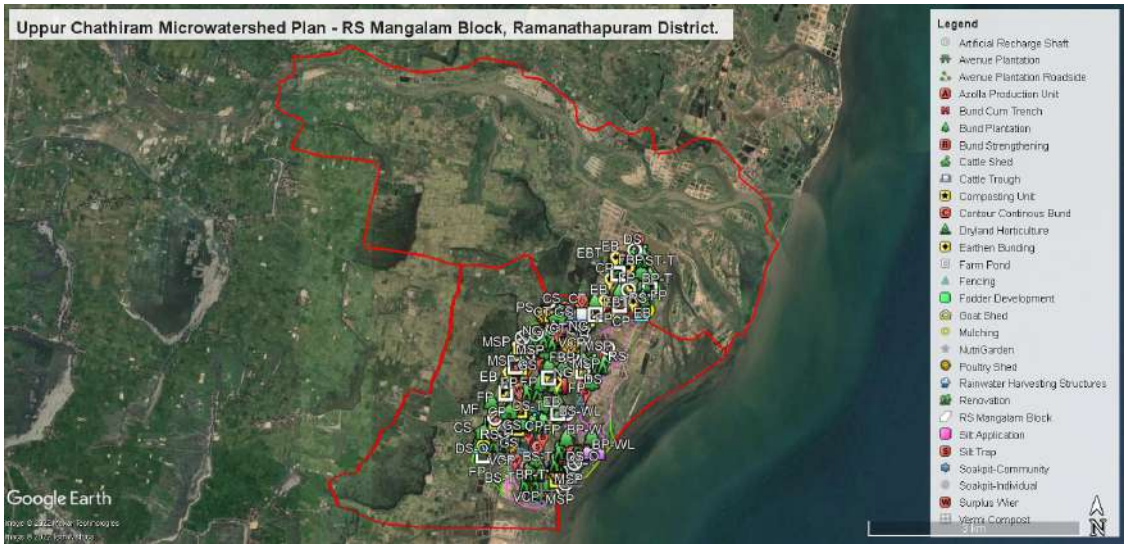


Figure 8.4. Proposed activities in Uppur Chathiram Micro-watershed

8.3 MODEL GP – KOTHIDAL

BACKGROUND OF GRAM PANCHAYAT – KOTHIDAL

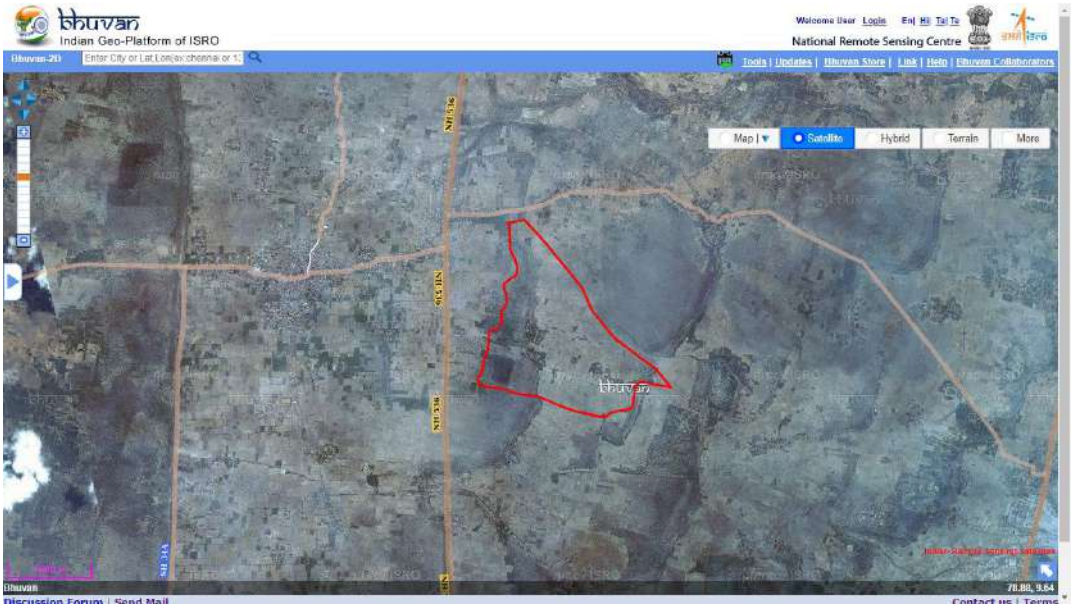
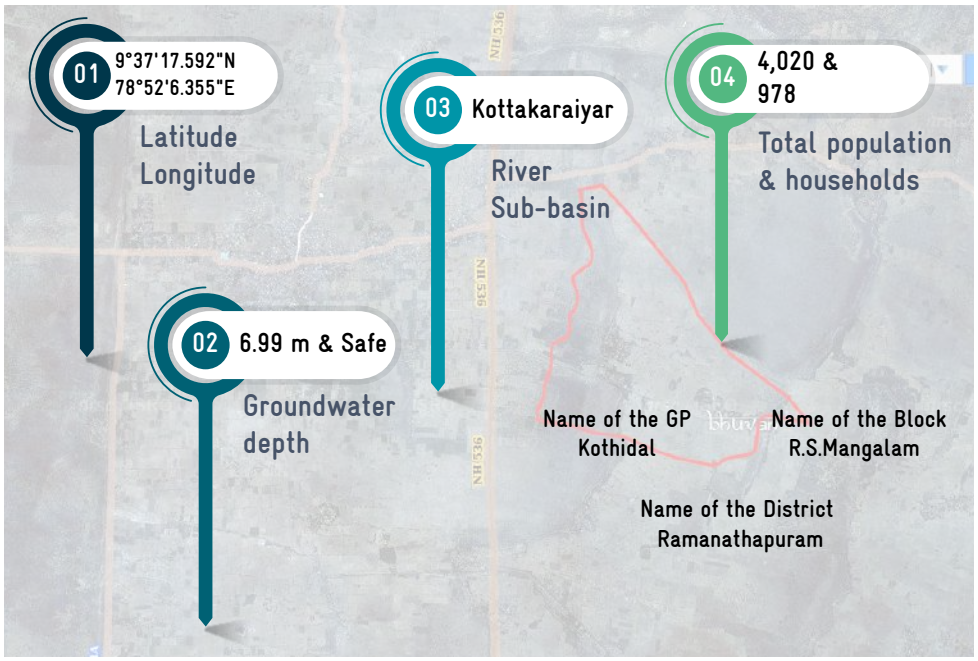


Figure 8.5. Satellite Image of Kothidal GP

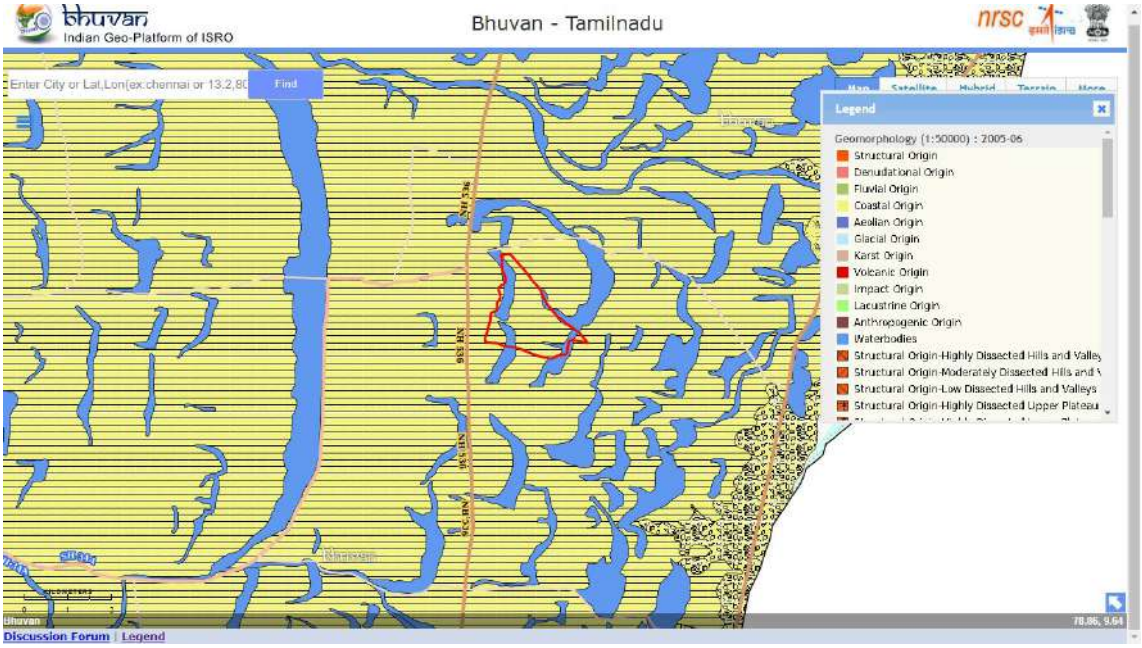
Kothidal GP is located in R S Mangalam Block of Ramanathapuram District, Tamil Nadu. The total geographic area of this village is about 261 ha. As per the Population Census 2011, the total population of the GP is 4,020 out of which 1,992 are males, 2,028 are females. The total number of HH in the village is 978. 29.72% of the population comprises of SC population. There is no ST population. (Table 50).

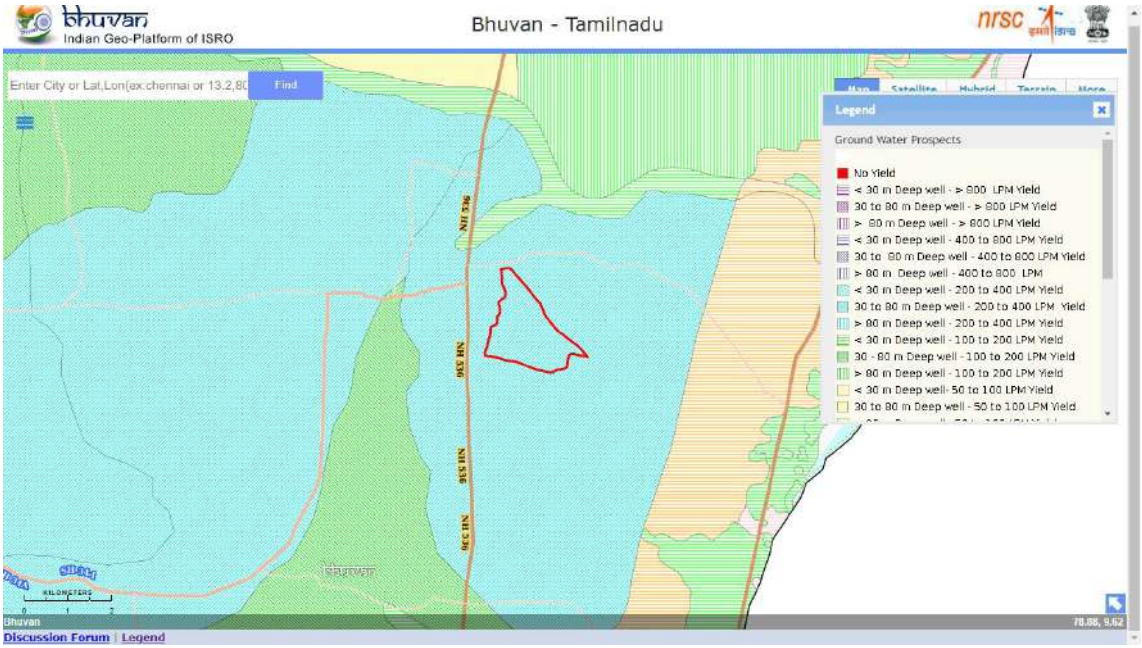
TABLE 50. GENERAL DESCRIPTION OF KOTHIDAL GP, R S MANGALAM BLOCK



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





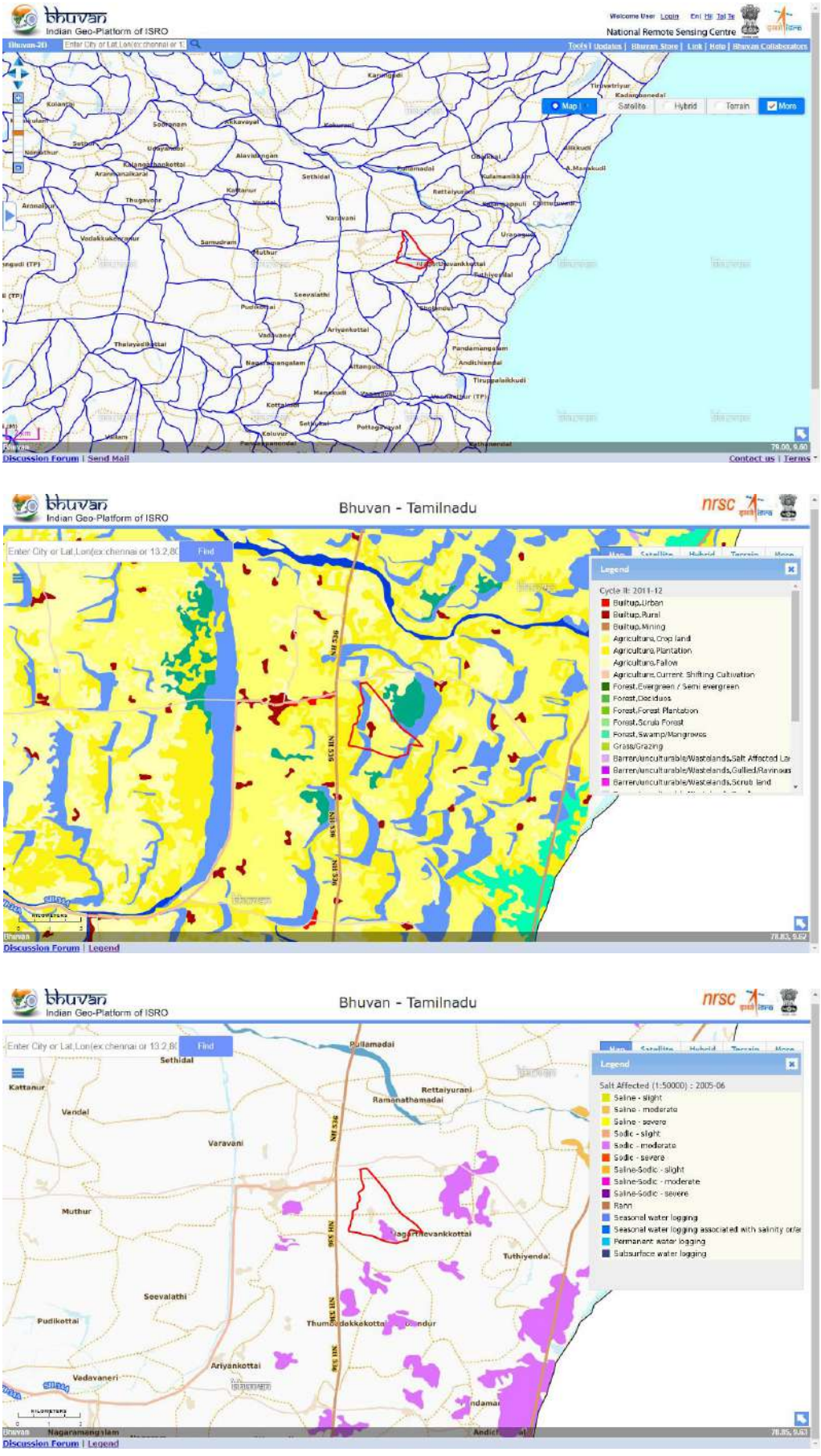


Figure 8.6. Spatial thematic maps of Kothidal GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. LULC, E. Salt affected area

Kothidal 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). A parcel of salt affected land found in the Southern region (E).

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 51). 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 51. NON-SPATIAL DATA-KOTHIDAL GP

Key CWRM Parameter	Details
Climate Vulnerability Area (CVA) 1: Socio-Economic	
Geographical Area	261
Male Population	1,992
Female Population	2,028
Total Population	4,020
SC Population	1,195
Vulnerable population	1,195
Households (HH's)	978
Only one room HH's (SECC)	23
Female Headed HH's (SECC)	36
Vulnerable Households (SECC)	27
% of Vulnerable Households	3
Registered MGNREGA Job cards	356
The active person working in job Cards	187
Drinking Water Sources	18
HH's have tap water connection for drinking water	120
HH's dependent on other sources for drinking water	222
Annual Greywater Generation	7
Climate Vulnerability Area (CVA) 3: Water Resources	
Canal Network (m)	
Length of Distributaries	2,000
Water Courses (Field Channels)	4,500
No. of Tanks (PWD & Union)	1
No. of Ooranis	3

Irrigation Facilities (ha)	
Area under Tank Irrigation	61.79
Area under Open & Tube Well Irrigation	2.65
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	13.8
Average Catchment Area	0.1
Bad Catchment Area	22.4
Watershed and Drainage Networks	
No. of Micro-watersheds	4
Water Demand (ha.m)	
Water Demand For Humans	11
Water Demand For Agriculture	1,105
% G.W Utilization for Drinking	67
% G.W Utilization for Livestock	91
% G.W Utilzation for Agriculture.	4
% SW Utilization for Drinking	33
% SW Utilization for Livestock	9
% SW Utilization for Agriculture	96
Climate Vulnerability Area 4: Agriculture	
Area Under Land Resources (ha)	
Non-Agricultural Uses	62.25
Cultivable Waste Land	0.38
Current Fallow land	61.79
Unirrigated Land	72.11
Area Irrigated by Source	63.23
Catchment Area (ha)	
Land under Good Catchment	62.25
Land under Average Catchment	0.38
Land under Bad Catchment	197.13
Crop Details (ha)	
Irrigated Area (ha)	425.94
Rainfed area (ha)	465.73
Area under Paddy Cultivation (ha)	891.66
Crop Water Requirement - Irrigated condition (ha.m)	638.9
Crop Water Requirement - Rainfed condition (ha.m)	465.73
Soil Resources: Status of Available Nitrogen (%)	
Very Low	1
Low	99

Status of Organic Carbon (%)	
Very Low	16
Low	84
Status of Soil Micro Nutrients (%)	
Sufficient	69
Deficient	31
Status of Physical condition of the soil (%)	
Moderately Acidic	57
Slighly Acidic	16
Moderately Alkaline	28
Soil Texture	
% of Fine Soil	64
% of Coarse loamy	19
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17%
Estimated Soil Moisture (ha.m)	33.58
ET Losses (ha.m)	70.65
Means of Water Extraction (%)	
Gravity	89
Lifting	11
Irrigation Methods (%)	
Wild Flooding	95
Control Flooding	5
Livestock (No)	
Cattle Population	76
Sheep Population	32
Goat Population	32
Poultry	123

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. Very High population density
2. Female population is higher than male population
3. 29.72 percent of the population belongs to the SC category and according to SECC data
4. 3% of the households are vulnerable, 36 HH are female headed
5. 23 HH have only one room
6. 7 ha.m grey water from 978 households living in the coast needs attention

Water

1. No major, minor canals, distributaries in this GP
2. 1 tank and 3 Ooranis in the GP
3. Drinking water depends 67% of ground-water
4. 96% of surface water utilized for agricul-ture
5. More water for agriculture (1,105 ha.m)
6. 36.3 ha.m of water is an available runoff in which 38% of the runoff is from the good catchment, 61.70 % of the conserva-tion is from the bad catchment

Agriculture and Allied Sector

1. 75.88 % is under Individual lands
2. More bad catchment area (75.88%)
3. rainfed area (52.23%)
4. Low soil Nitrogen and Organic Carbon
5. 57 % moderately Acidic
6. 64% fine soil
7. 95% Wild flooding
8. Area under paddy cultivation 891.66 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 3.21% of the total land area is taken for WASCA activities like plantation, conservation works. The total proposed area for treatment is 8.34 ha out of which 70.86% of the proposed work is under individual lands (Figure 8.7). Through the proposed conservation activities, 2.51 ha.m run off would be harvested in which, about 70 % of the runoff is from the good catchment, 27% of the run off is from the bad catchment and the remaining is from the average catchment area (Figure 8.8).

Figure 8.7. Proposed land resource treatment area in Kothidal GP

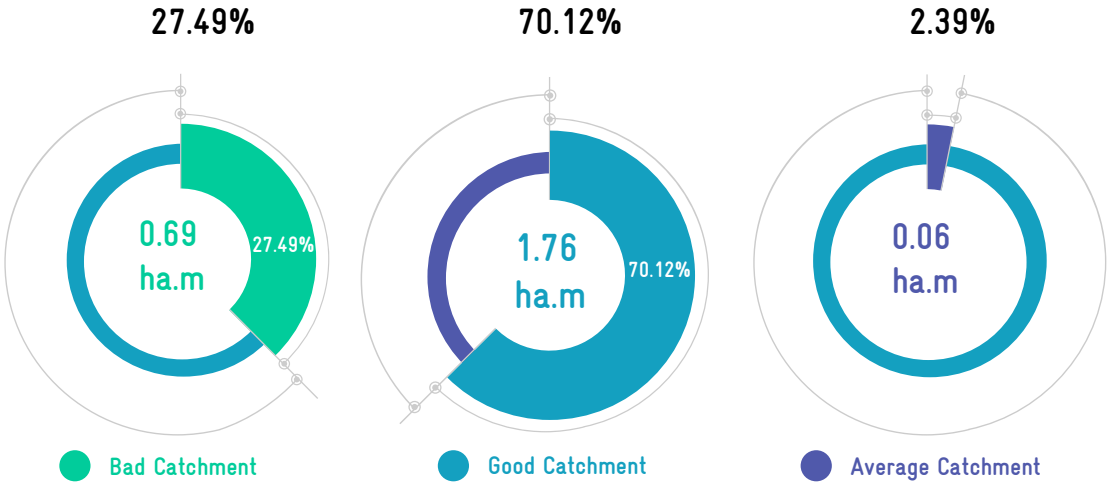


Figure 8.8. Expected run off conservation after treatment in Kothidal GP

Table 52 shows the detailed perspective plan and estimates of the work, budget, and person-days for three years from 2021-2022 to 2023-2024 in Kothidal GP. Since it is a vulnerable village, attention was given to include appropriate works to improve the common and public land development.

TABLE 52. PERSPECTIVE PLAN OF KOTHIDAL 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 (ha)	Lower	2	18.06	7,022.4
Contour Continuous Bunds (CCB) for Afforestation area (m)		8	0.21	84
Composting (No.)		822	139.74	12,330
Avenue plantation (km)		2	3.43	1,341
Block Plantation (Community)		1	11.1	4,320
Deepening of water bodies (No.)		4	11	1,400
Artificial Recharge Structure (No.)		1	2.5	391
Canal Bund Plantation (km)		574	4,305	16,81,820
WC - Irrigation channels - Desilting		113	0.85	339.9
Subtotal Water Action – I		**1,528**	**4,492**	**17,09,048**
CWRM Water Action 2: Agricultural and allied Sector development				
CWRM Water Action 2: Works in Lower Ridge				
Farm Bunding (ha)	Lower	6	8.87	3,463
Micro Irrigation (ha)		1	1	0
Construction of farm ponds (No.)		2	4	1,562
Land development (ha)		2	20.1	7,851
Cattle Shelters (No.)		2	4.24	662
Goat Sheep Shelters (No.)		4	9.08	1,420
Fodder development for cattle (No.)		2	2.96	4,688
Azolla units (No.)		2	0.3	46
Cattle Trough (No.)		2	0.1	12
Poultry shed (No.)		3	0.27	30
Dry land Horticulture/Agro-forestry		3	25.5	9,963
Vermi Compost (No.)		2	0.36	54
Subtotal Water Action – II		**31**	**76.78**	**29,751**

CWRM Water Action 3: Rural Water Management				
CWRM Water Action 3: Works in Lower Ridge				
Soak pits (Community) (No.)	Lower	10	1.3	200
Soak pits (Individual) (No.)		100	10	1,600
Roof rain Water Harvesting (No.)		70	280	43,750
Community Tanka (Rajasthan Model) (No.)		1	30	300
Subtotal Water Action – III		181	321.3	45,850
Overall Total GP		1,740	4,890	17,84,649

Water actions

Regarding CWRM themes, of the total number of projects identified, 87.81 percent works are in public and common land, 1.78 percent in agriculture and allied sector while it is 10.40 percent under rural infrastructure (Table 53).

TABLE 53. 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	1,528	4,492	17,09,048
Agriculture and Allied sector development	31	76.78	29,751
Rural water management	181	321.3	45,850
TOTAL	1,740	4,890	17,84,649

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 54). 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 54. 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	4 water bodies restored
2	Area under afforestation	2	2.5 ha.m surface runoff is harvested due to WASCA interventions
3	Quantum of water harvested/recharge	3	62.63 percent of the total area treated under WASCA (2.43 ha)
4	The proportion of land treated under WASCA	4	2.1 ha area under afforestation
5	Drainage Line Treatment	5	Nil

4
TRADITIONAL WATER BODIES RESTORED

2.1 ha
AFFORESTATION

2.5 ha.m
RUNOFF HARVESTED

62.63 %
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	2 farm ponds established
2	No structures were established for on-farm (in-situ) water harvesting in drylands	2	2 compost units for soil health improve-ment
3	Improvement in soil health	3	5.91 ha Farm bunding with trenches
4	Changes in the irrigation practices	4	3 ha under dryland horticulture
5	Dryland development with agro-forestry	5	2 vulnerable households established fodder plots
6	Households established fodder plots		

2
FARM PONDS

2
VERMI COMPOST

5.91 ha
FARM BUNDING

3 ha
DRYLAND HORTICULTURE

2
FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

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

OUTCOMES/ IMPACT	
1	10 common and 100 individual soak pits were established for recycling greywater benefiting 357 households
2	2 common roof rainwater harvesting and storage

10 COMMUNITY &
100 INDIVIDUAL SOAK PITS

2
COMMON ROOF RAINWATER HARVESTING

Table 55 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 55. PROPOSAL FOR THE MGNREGS, KOTHIDAL GP, R S MANGALAM BLOCK

	No of works	No of person days
Perspective plan	1,740	17,84,649
Annual plan	696	7,13,860

8.3.6 PROPOSED ACTIVITY MAP

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

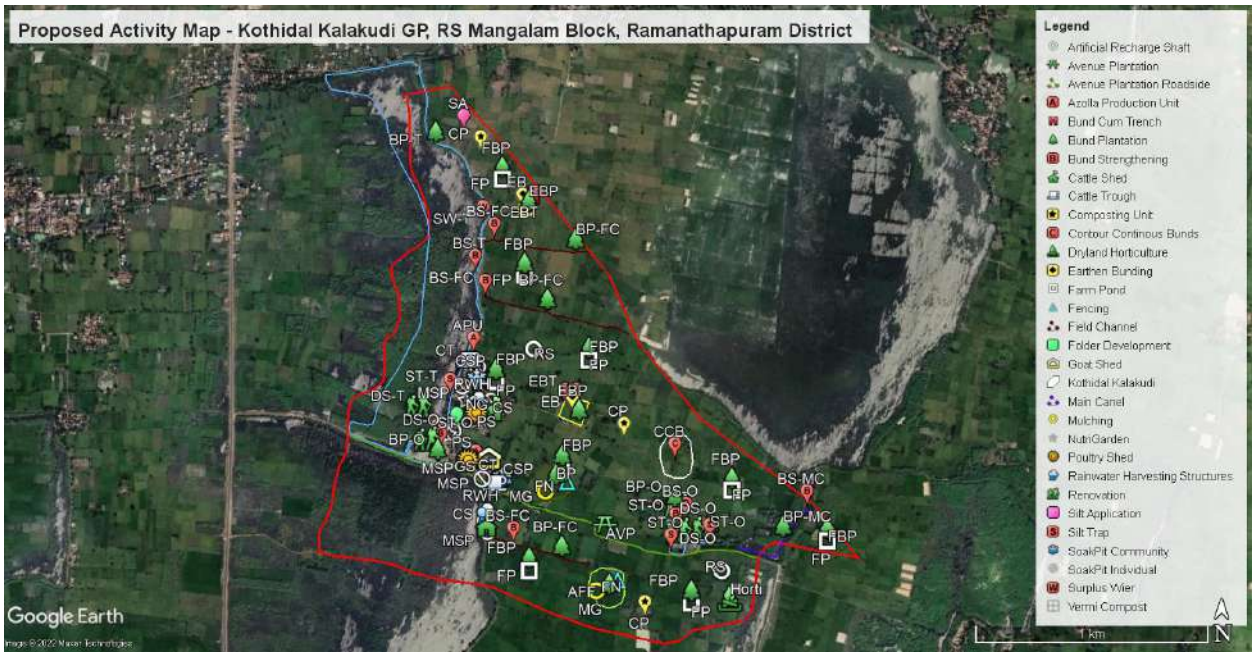
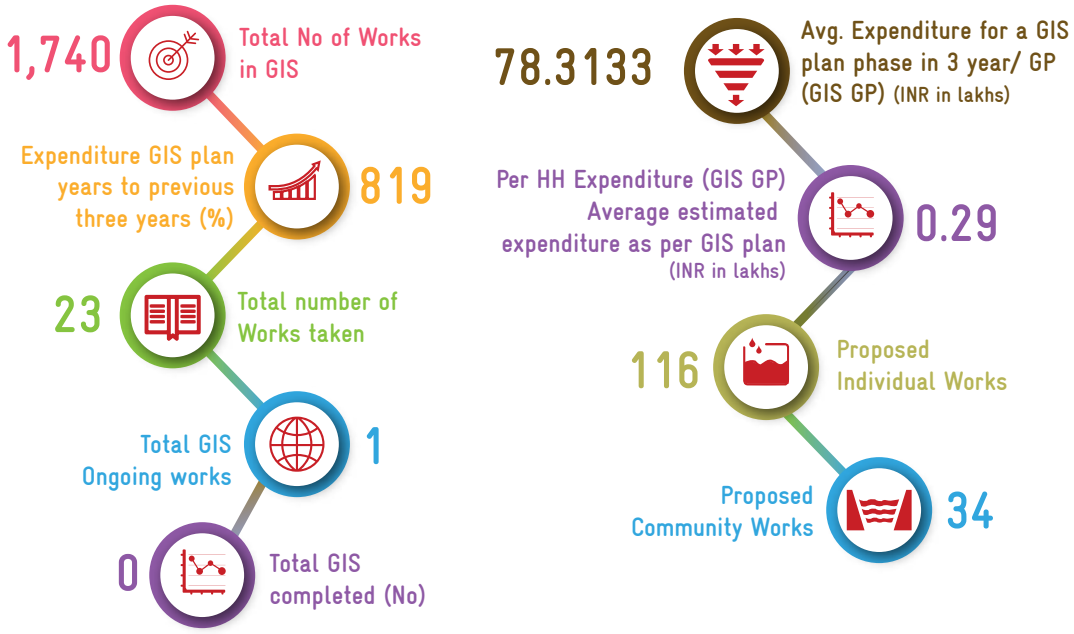


Figure 8.9. Proposed action plan of Kothidal GP

8.3.7 GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Kothidal GP, R S Mangalam Block is represented in Table 56.

TABLE 56. 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

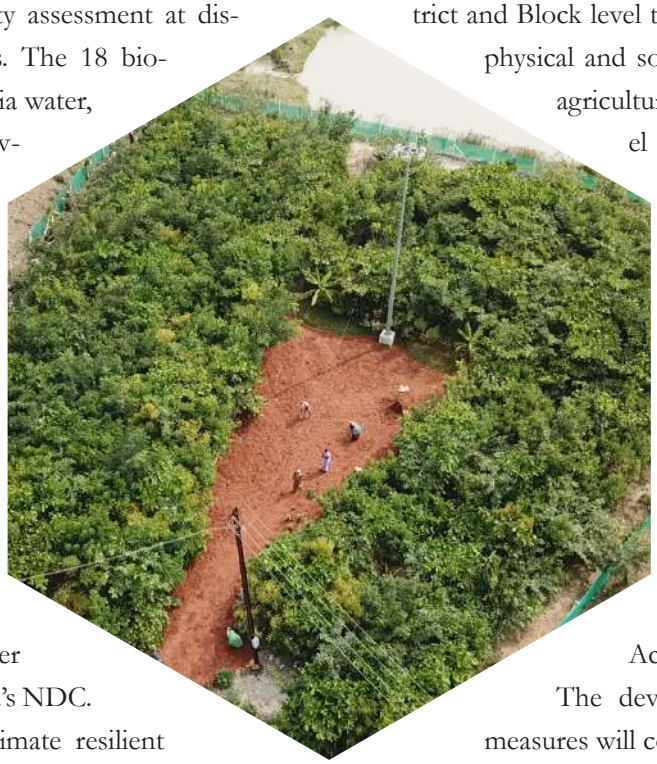
Thirukkural - 20

CHAPTER 9

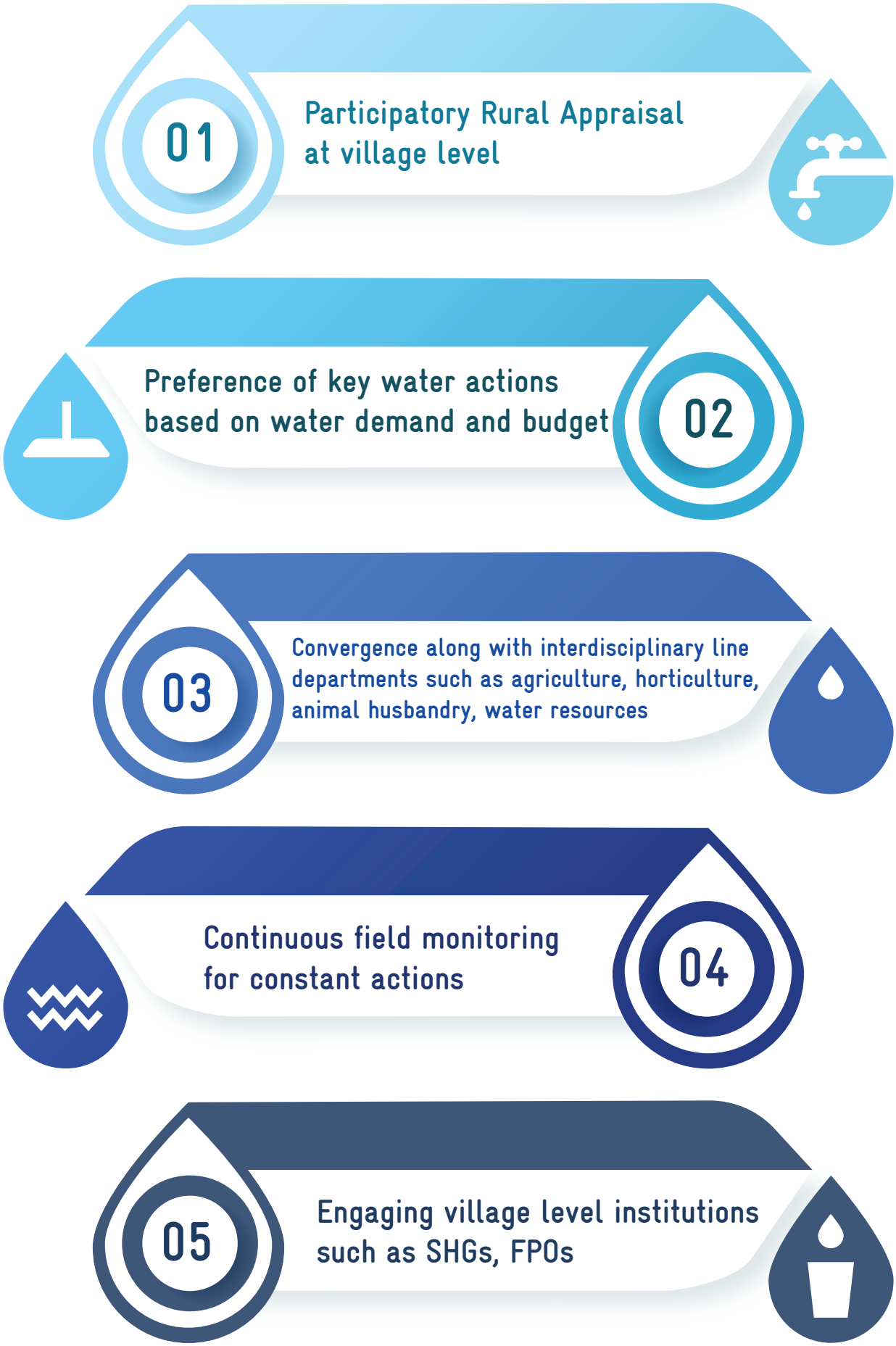
CONCLUSION

"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 Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)
Radhanur	-	-	-	-	12	15	1
Tiruppalaikkudi	-	1,852	2,500	3,654	1	15	-
Chiituruvadi	1,200	560	986	498	8	4	-
Alagarthevankottai	3,050	2,500	1,965	4,562	4	12	-
Karkathakudi	-	6,258	6,253	18,258	5	20	-
Thumbadakottai	1,400	6,502	2,500	3,350	3	20	-
Sethidal	2,300	-	-	1,500	4	8	-
Urangudi	-	-	965	4,000	1	6	-
Sholandur	1,200	2,562	1,965	6,000	3	8	-
Senkudi	200	1,300	1,000	1,500	2	4	-
Varavani	-	250	1,280	2,800	3	8	-
Govindamangalam	3,952	4,500	2,300	1,790	8	14	-
Sevvaipettai	-	4,110	2,000	5,000	6	11	-
Anandur	-	3,400	2,488	6,000	2	9	-
Sirunagudi	-	1,290	1,690	3,900	8	7	-
Pullamadai	1,900	2,500	3,600	2,365	2	16	-
Sattanur	600	2,300	1,800	6,500	8	12	-
Arunuthimangalam	265	1,589	3,989	5,360	9	25	-
Odaikkal	-	1,650	-	2,320	2	7	-
Paranur	-	1,200	2,252	1,850	5	7	-
Thiruthervalai	2,500	2,000	6,585	8,500	7	10	-
Ayangudi	-	3,690	2,500	4,200	6	14	-
Gudalur	-	2,500	6,650	6,500	6	9	-
Vadakalur	2,000	1,900	6,000	8,000	5	13	-

Gram Panchayat	Canal Irrigation				Tradational Water bodies		
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)
Kadalur	-	2,000	1,500	3,000	6	9	-
Kavanoor	1,500	2,000	3,000	6,000	6	16	-
Kothaidal	-	-	2,000	4,500	1	3	-
Kallikudi	-	2,000	5,600	5,000	12	16	-
Kavanakottai	200	2,000	5,000	8,000	6	13	-
Sanavelli	-	3,409	4,387	2,300	11	13	-
Karungudi	-	2,600	5,690	6,000	12	10	-
Pitchanakurichi	400	4,587	2,300	1,455	7	7	-
Kottagudi	-	600	3,600	4,500	10	15	-
A.Manakudi	600	2,963	6,302	3,000	12	9	-
Melapanaiyur	-	600	8,500	11,000	9	11	-

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.)
Radhanur	210.27	17.08	356.23	4.00	-	200.00	3,728.14	7.00	9.00
Tiruppalaikkudi	163.78	-	20.00	16.00	2.00	70.90	4,242.30	3.00	3.00
Chiituruvadi	239.54	-	3.00	46.60	2.90	139.80	3,418.00	5.00	8.00
Alagarthevankottai	483.75	-	1.38	95.10	0.10	105.70	3,196.00	2.00	7.00
Karkathakudi	336.61	-	10.00	51.30	-	340.40	-	-	8.00
Thumbadakottai	542.42	-	0.80	50.10	-	146.40	962.04	2.00	8.00
Sethidal	60.06	-	-	45.00	0.80	104.80	3,369.35	1.00	4.00
Urangudi	210.02	-	-	14.80	-	32.00	-	-	4.00
Sholandur	207.78	-	-	22.60	-	67.10	-	-	4.00
Senkudi	46.28	78.25	12.02	15.60	-	47.90	-	-	2.00
Varavani	82.10	-	7.25	6.60	-	121.40	-	-	4.00
Govindamangalam	245.10	-	122.82	30.00	1.60	82.20	1,605.57	1.00	8.00
Sevvaipettai	98.36	-	6.35	20.00	1.10	54.80	1,964.35	1.00	9.00
Anandur	98.36	-	6.35	9.00	-	37.70	792.59	1.00	6.00
Sirunagudi	23.67	-	2.67	13.20	-	56.50	-	-	4.00
Pullamadai	86.20	97.12	20.60	143.10	2.60	177.10	-	-	10.00
Sattanur	85.41	65.20	12.00	24.00	-	116.70	-	-	7.00
Arunuthimangalam	411.70	-	60.55	16.10	19.40	47.00	-	-	5.00
Odaikkal	22.00	-	0.40	21.70	0.70	39.90	-	-	1.00
Paranur	6.18	-	-	74.60	1.30	119.50	-	-	4.00
Thiruthervalai	194.39	58.36	25.02	9.00	1.50	74.30	1,468.05	3.00	5.00
Ayangudi	207.29	58.25	126.18	14.00	0.60	134.40	-	-	6.00
Gudalur	98.25	-	5.35	71.20	-	80.10	-	-	5.00
Vadakalur	99.36	-	2.36	27.40	-	30.80	636.35	1.00	2.00
Kadalur	126.09	-	2.65	119.70	0.40	62.80	2,943.85	6.00	6.00

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.)
Kavanoor	158.02	-	2.36	98.20	11.00	165.80	11,887.42	10.00	9.00
Kothaidal	61.79	-	2.65	13.80	0.10	22.40	-	-	4.00
Kallikudi	337.62	-	144.38	106.80	2.00	68.20	-	-	5.00
Kavanakottai	272.02	59.36	188.69	29.60	2.20	145.20	-	-	8.00
Sanavelli	33.77	12.88	2.77	6.70	19.80	130.50	-	-	7.00
Karungudi	430.79	-	111.63	6.00	6.00	145.90	-	-	9.00
Pitchanakurichi	255.53	-	36.64	14.30	-	97.40	-	-	9.00
Kottagudi	281.94	-	135.67	38.10	14.60	83.80	-	-	7.00
A.Manakudi	219.92	-	112.90	90.90	22.20	83.00	1,257.50	3.00	5.00
Melapanaiyur	90.25	58.00	5.20	27.90	5.00	51.90	-	-	9.00

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 (%)
Radhanur	6.58	1.12	1,170.01	100	90	61	-	10	39
Tiruppalaikkudi	24.16	3.73	291.66	92	89	11	8	11	89
Chiituruvadi	5.34	1.57	664.48	20	79	1	80	21	99
Alagarthevankottai	5.08	1.42	1,144.03	91	79	-	9	21	100
Karkathakudi	6.16	1.08	929.51	84	88	3	16	12	97
Thumbadakottai	7.12	1.49	1,221.49	98	88	-	2	12	100
Sethidal	4.92	0.87	678.24	87	95	10	13	5	90
Urangudi	2.95	0.41	307.53	100	86	32	-	14	68
Sholandur	4.74	0.70	548.13	100	90	-	-	10	100
Senkudi	3.51	0.57	263.47	98	85	9	2	15	91
Varavani	3.89	0.97	534.87	85	87	8	15	13	92
Govindamangalam	7.71	1.93	999.68	97	96	33	3	4	67
Sevvaipettai	7.71	1.29	999.68	96	96	6	4	4	94
Anandur	9.87	0.67	745.49	100	89	6	-	11	94
Sirunagudi	9.87	0.97	745.49	100	93	10	-	7	90
Pullamadai	9.95	1.04	1,318.26	90	59	10	10	41	90
Sattanur	9.50	1.41	809.65	88	54	7	12	46	93
Arunuthimangalam	13.76	2.02	1,001.05	74	85	13	26	15	87
Odaikkal	0.97	0.58	170.23	89	25	19	11	75	81
Paranur	0.66	2.02	139.92	95	92	8	5	8	92
Thiruthervalai	5.79	1.32	722.97	100	88	9	-	12	91
Ayangudi	2.55	1.98	723.49	100	88	32	-	12	68
Gudalur	7.37	1.86	1,237.63	100	91	5	-	9	95
Vadakalur	7.37	0.72	1,237.63	100	91	2	-	9	98
Kadalur	11.07	1.48	847.29	95	88	2	5	12	98
Kavanoor	2.74	0.62	1,104.63	100	98	1	-	2	99

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 Utilzation for Agriculture. (%)	% SW Utilization for Drinking (%)	% SW Utilization for Livestock (%)	% SW Utilization for Agriculture (%)
Kothaidal	11.00	0.30	1,104.63	67	91	4	33	9	96
Kallikudi	3.31	0.83	688.20	96	90	30	4	10	70
Kavanakottai	1.75	1.96	1,063.02	100	92	36	-	8	64
Sanavelli	4.98	3.04	1,001.05	96	79	6	4	21	94
Karungudi	6.06	4.54	1,146.67	100	96	21	-	4	79
Pitchanakurichi	-	1.33	740.97	-	90	13	100	10	87
Kottagudi	14.83	0.90	765.13	100	96	33	-	4	67
A.Manakudi	3.99	0.98	566.39	100	69	34	-	31	66
Melapanaiyur	4.49	0.59	678.50	100	93	3	-	7	97

ANNEXURE 3.8

LOCATION WISE WATER QUALITY IN R S MANGALAM BLOCK DURING PRE-MONSOON SEASON

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
A Manakudi	A Manakudi	E 78° 56' 53.635"	N 9° 39' 59.198"	Bore well	7.36	0	635	371	368
A Manakudi	Kannarenthal	E 78° 55' 49.854"	N 9° 40' 2.917"	Open well	7.34	0	490	285	364
Alagardevankottai	RS Mangalam	E 78° 50' 55.525"	N 9° 38' 33.324"	Bore well	7.14	0	7,870	4,930	327
Anandur	Anandur	E 78° 46' 49.3"	N 9° 43' 51.528"	Open well	6.7	0	6,890	4,390	281
Anandur	Valanai	E 78° 46' 32.279"	N 9° 43' 53.645"	Bore well	7.06	0	10,020	6,310	313
Ayankudi	Ayankudi	E 78° 49' 6.82"	N 9° 43' 16.237"	Bore well	6.7	2	11,670	7,360	280
Ayankudi	Karunkudi	E 78° 49' 28.279"	N 9° 43' 39.706"	Bore well	6.9	0	7,500	4,800	316
Govindamangalam	Govindamangalam	E 78° 47' 20.782"	N 9° 45' 33.152"	Bore well	6.78	0	8,650	4,430	290
Gudalur	Gudalur	E 78° 51' 7.754"	N 9° 43' 43.28"	Bore well	7.26	0	962	605	313
Kadaloor	Kadalur	E 78° 55' 55.974"	N 9° 37' 40.224"	Open well	6.56	0	7,390	4,600	268
Kadaloor	Uppur	E 78° 55' 42.467"	N 9° 36' 55.584"	Open well	6.47	15	38,890	24,450	259
Karkathakudi	Karkathakudi	E 78° 52' 57.893"	N 9° 44' 31.621"	Bore well	6.9	0	3,740	2,270	301
Karungudi	Kathiyarkottai	E 78° 53' 13.297"	N 9° 34' 14.761"	Open well	7.57	0	901	561	410
Kavanakottai	Kavanakottai	E 78° 50' 12.16"	N 9° 42' 1.206"	Bore well	6.89	1	11,020	6,900	301
Melapanaiyur	Aayiraveli	E 78° 54' 26.989"	N 9° 43' 10.97"	Bore well	7.04	0	856	427	313
Melapanaiyur	Melapanaiyoor	E 78° 53' 11.98"	N 9° 43' 9.588"	Bore well	7.45	0	715	437	396
Odaikaal	Odaikaal	E 78° 52' 53.544"	N 9° 40' 4.066"	Open well	6.21	10	30,670	18,430	234
Paranur	Kalangappuli	E 78° 53' 52.303"	N 9° 38' 34.663"	Bore well	6.56	5	8,200	5,190	269
Paranur	Paranoor	E 78° 53' 9.121"	N 9° 38' 44.7"	Bore well	7.15	0	6,400	3,900	327
Pullamadai	Pullamadai	E 78° 51' 0.31"	N 9° 39' 54.745"	Bore well	6.67	5	16,340	9,060	279
R S Mangalam_TP	Mangalam	E 78° 51' 44.37"	N 9° 36' 41.364"	Bore well	6.71	0	8,250	5,110	283
Radhanur	Radhanur	E 78° 45' 41.335"	N 9° 45' 45.472"	Bore well	7.06	0	4,280	2,840	313
Sanaveli	Sanaveli	E 78° 52' 15.557"	N 9° 41' 4.38"	Bore well	7.44	0	2,867	1,734	395
Sathanur	Annayankottai	E 78° 45' 10.958"	N 9° 44' 50.028"	Bore well	7.48	0	2,382	1,491	398
Sathanur	Nemam	E 78° 43' 52.093"	N 9° 44' 33.428"	Bore well	6.73	0	5,040	2,520	289

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Sathanur	Sattanoor	E 78° 45' 17.986"	N 9° 43' 28.61"	Bore well	6.63	3	15,770	9,890	276
Sathanur	Viruthanvayal	E 78° 44' 18.816"	N 9° 44' 57.368"	Bore well	6.85	0	8,860	5,520	300
Sengudi	Sengudi	E 78° 48' 31.154"	N 9° 38' 5.374"	Bore well	6.99	0	6,600	4,180	307
Solandur	Near Solanthoor	E 78° 51' 36.209"	N 9° 33' 56.221"	Open well	6.84	0	10,370	6,500	297
Solandur	Solanthoor	E 78° 51' 36.725"	N 9° 33' 37.05"	Open well	7.76	0	377	214	446

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
A Manakudi	99	239	76	35	19	75	8	12	83	14	46	0.08
A Manakudi	78	267	58	27	15	82	6	16	58	12	39.9	0.08
Alagardevankottai	87	213	938	429	240	1,025	18	45	2,658	8	517.8	1.45
Anandur	58	213	821	375	210	562	15	44	1,956	15	411.2	1.04
Anandur	47	233	1,194	546	306	1,005	23	14	2,715	35	596	1.42
Ayankudi	60	198	320	40	90	2,365	19	58	4,251	22	729.5	2.47
Ayankudi	70	201	572	353	96	1,205	17	52	2,528	25	481.7	1.45
Govindamangalam	86	186	1,031	471	264	586	8	12	2,485	15	468	1.19
Gudalur	58	247	168	69	42	80	7	26	185	11	68.9	0.15
Kadaloor	87	157	881	403	226	589	16	156	1,784	53	428.5	1.20
Kadaloor	94	151	590	80	470	4,270	42	120	7,567	47	1745.1	4.51
Karkathakudi	98	184	450	280	22	452	12	12	1,201	10	230.1	0.62
Karungudi	117	263	107	49	28	123	8	10	213	12	67.3	0.14
Kavanakottai	94	196	1,314	601	336	1,124	24	58	3,854	25	710.8	1.98
Melapanaiyur	66	233	102	47	26	101	5	11	182	6	56.3	0.13
Melapanaiyur	96	287	400	39	22	95	6	12	195	14	58.1	0.13
Odaikaal	34	182	3,656	1,671	936	859	12	60	6,985	12	1510	3.20
Paranur	86	151	978	447	250	587	37	134	2,100	87	486.2	1.28
Paranur	68	243	763	349	195	754	15	50	2,152	6	418.2	1.18
Pullamadai	94	155	1,948	890	499	1,125	20	22	4,758	6	898.4	2.28
R S Mangalam_TP	59	214	983	450	252	856	22	42	2,562	5	509.4	1.36
Radhanur	52	233	520	120	22	685	9	12	1,250	12	254.2	0.71
Sanaveli	98	287	342	156	88	257	10	11	802	5	175.8	0.42
Sathanur	96	265	284	130	73	285	8	12	652	12	155.5	0.37
Sathanur	87	184	410	200	179	425	14	11	1,520	12	285.9	0.76
Sathanur	69	186	1,880	859	481	1,526	22	15	5,231	12	978.7	2.57
Sathanur	68	195	106	48	27	1,512	10	15	2,452	10	472.9	1.43
Sengudi	68	200	250	80	134	1,252	25	32	2,152	4	418.3	1.29
Solandur	82	193	350	280	45	1,586	20	26	3,254	28	593.8	1.78
Solandur	121	291	45	21	12	61	28	13	69	10	37.2	0.07

ANNEXURE 3.9

LOCATION WISE WATER QUALITY IN R S MANGALAM BLOCK DURING POST-MONSOON SEASON

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
A Manakudi	A Manakudi	E 78° 56' 53.635"	N 9° 39' 59.198"	Bore well	6.57	1	7,690	4,768	586
A Manakudi	Kannarenthal	E 78° 55' 49.854"	N 9° 40' 2.917"	Open well	6.39	1	6,570	4,073	549
Alagardevankottai	RS Mangalam	E 78° 50' 55.525"	N 9° 38' 33.324"	Bore well	6.75	0	5,850	3,627	485
Anandur	Anandur	E 78° 46' 49.3"	N 9° 43' 51.528"	Open well	6.99	0	1,721	1,067	210
Anandur	Valanai	E 78° 46' 32.279"	N 9° 43' 53.645"	Bore well	7.1	0	3,589	2,225	791
Ayankudi	Ayankudi	E 78° 49' 6.82"	N 9° 43' 16.237"	Bore well	6.76	1	8,420	5,220	713
Ayankudi	Karunkudi	E 78° 49' 28.279"	N 9° 43' 39.706"	Bore well	6.35	1	8,100	5,022	642
Govindamangalam	Govindamangalam	E 78° 47' 20.782"	N 9° 45' 33.152"	Bore well	6.68	2	5,800	3,596	499
Gudalur	Gudalur	E 78° 51' 7.754"	N 9° 43' 43.28"	Bore well	7.15	0	6,230	3,863	438
Kadaloor	Kadalur	E 78° 55' 55.974"	N 9° 37' 40.224"	Open well	7.65	0	279	173	79
Kadaloor	Uppur	E 78° 55' 42.467"	N 9° 36' 55.584"	Open well	7.5	0	183	113	48
Karkathakudi	Karkathakudi	E 78° 52' 57.893"	N 9° 44' 31.621"	Bore well	6.74	0	2,884	1,788	286
Karungudi	Kathiyarkottai	E 78° 53' 13.297"	N 9° 34' 14.761"	Open well	6.94	0	6,820	4,228	524
Kavanakottai	Kavanakottai	E 78° 50' 12.16"	N 9° 42' 1.206"	Bore well	6.31	0	2,556	1,585	306
Melapanaiyur	Aayiraveli	E 78° 54' 26.989"	N 9° 43' 10.97"	Bore well	6.83	0	684	424	113
Melapanaiyur	Melapanaiyoor	E 78° 53' 11.98"	N 9° 43' 9.588"	Bore well	7.08	0	701	435	103
Odaikaal	Odaikaal	E 78° 52' 53.544"	N 9° 40' 4.066"	Open well	6.83	0	274	170	73
Paranur	Kalangappuli	E 78° 53' 52.303"	N 9° 38' 34.663"	Bore well	7.06	1	3,215	1,993	355
Paranur	Paranoor	E 78° 53' 9.121"	N 9° 38' 44.7"	Bore well	7.24	0	2,264	1,404	289
Pullamadai	Pullamadai	E 78° 51' 0.31"	N 9° 39' 54.745"	Bore well	6.71	5	16,400	10,168	746
R S Mangalam_TP	Mangalam	E 78° 51' 44.37"	N 9° 36' 41.364"	Bore well	6.92	0	6,530	4,049	573
Radhanur	Radhanur	E 78° 45' 41.335"	N 9° 45' 45.472"	Bore well	7.06	0	2,442	1,514	241
Sanaveli	Sanaveli	E 78° 52' 15.557"	N 9° 41' 4.38"	Bore well	7.17	0	2,132	1,322	274
Sathanur	Annayankottai	E 78° 45' 10.958"	N 9° 44' 50.028"	Bore well	7.72	0	2,042	1,266	211
Sathanur	Nemam	E 78° 43' 52.093"	N 9° 44' 33.428"	Bore well	6.52	0	4,130	2,561	326

Gram Panchayat	Location	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Sathanur	Sattanoor	E 78° 45' 17.986"	N 9° 43' 28.61"	Bore well	6.47	3	14,690	9,108	1,027
Sathanur	Viruthanvayal	E 78° 44' 18.816"	N 9° 44' 57.368"	Bore well	6.4	0	3,786	2,347	325
Sengudi	Sengudi	E 78° 48' 31.154"	N 9° 38' 5.374"	Bore well	6.93	1	9,270	5,747	672
Solandur	Near Solanthoor	E 78° 51' 36.209"	N 9° 33' 56.221"	Open well	6.94	0	7,330	4,545	557
Solandur	Solanthoor	E 78° 51' 36.725"	N 9° 33' 37.05"	Open well	6.73	0	7,480	4,638	432

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
A Manakudi	93	486	576	276	289	334	46	195	762	56	356.3	0.668
A Manakudi	84	452	483	256	213	376	39	212	726	67	317.4	0.661
Alagardevankottai	88	380	339	173	153	266	62	134	563	61	260.5	1.467
Anandur	26	176	161	66	81	96	13	47	234	16	99.2	0.743
Anandur	51	740	296	116	167	156	34.1	237.93	321.5	19.529	183.1	1.417
Ayankudi	126	574	473	257	208	356	66	124	726	93	357.1	2.916
Ayankudi	114	519	502	276	214	337	42	113	755	82	348.9	1.737
Govindamangalam	82	406	385	177	192	238	54	155	526	76	267.9	1.023
Gudalur	73	356	376	193	176	275	58	121	613	48	276	0.519
Kadaloor	16	60	32	13	9	11	2	5	27	1.518	24.2	0.621
Kadaloor	6	42	22	10	4	8	1	2	16.3	0.992	19.3	4.372
Karkathakudi	38	234	177	92	69	208	33	114	316	34	144.1	0.729
Karungudi	93	423	577	268	295	395	74	156	811	79	351.9	0.709
Kavanakottai	37	256	206	85	106	127	28	106	316	26	136.3	1.413
Melapanaiyur	17	91	57	31	13	19	6.5	16	62	5	38.2	0.15
Melapanaiyur	13	86	52	28	15	23	8	13	56	4	38.8	0.138
Odaikaal	13	57	34	15	10	11	3	2	37	6	24.8	0.899
Paranur	57	286	253	135	106	246	42	116	421	38	174.6	0.926
Paranur	35	241	228	97	115	163	26	86	376	18	142.3	1.049
Pullamadai	185	539	168	567	486	683	86	186	1652	121	705.4	2.207
R S Mangalam_TP	92	463	440	231	195	349	65	127	664	53	299.7	1.345
Radhanur	43	189	179	96	68	113	31	114	284	37	127.6	0.95
Sanaveli	46	210	174	69	93	99	25	96	243	35	119.2	0.48
Sathanur	32	173	177	78	86	97	26	97	266	22	116	0.52
Sathanur	66	246	326	167	143	212	43	125	571	38	212	0.849
Sathanur	159	859	978	496	464	617	129	218	1506	113	647.1	2.568
Sathanur	53	266	319	134	168	243	37	142	535	44	208.7	1.959
Sengudi	105	549	586	278	296	385	73	148	746	104	403.7	1.822
Solandur	86	456	562	289	251	433	58	206	952	58	363.2	2.311
Solandur	72	346	542	246	278	409	62	187	845	47	356.3	0.687

ANNEXURE 3.10

GP WISE STATUS OF AGRICULTURE RESOURCE

Gram Panchayat	Land Resources (ha)									
	Area under Forest land	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing 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
Radhanur	-	17.83	-	-	-	-	32.17	903.08	241.48	583.58
Tiruppalaikkudi	-	49.00	23.00	-	-	12.00	397.29	12.74	50.58	163.78
Chiituruvadi	-	210.00	-	-	-	17.00	640.29	-	350.17	240.54
Alagarthevankottai	-	428.89	-	-	-	0.71	-	143.90	297.80	488.75
Karkathakudi	-	231.41	-	-	-	0.16	1.05	92.62	525.20	2,377.51
Thumbadakottai	-	226.00	-	-	-	-	486.86	18.52	234.80	548.22
Sethidal	-	203.06	-	-	-	4.43	0.09	131.38	730.78	60.06
Urangudi	-	66.72	-	-	-	0.05	-	6.50	65.48	210.02
Sholandur	-	73.08	29.00	-	-	-	47.05	127.06	207.88	208.28
Senkudi	-	70.29	-	-	-	-	133.63	126.92	114.59	46.28
Varavani	-	29.71	-	-	-	-	404.96	1.28	572.34	89.82
Govindamangalam	-	71.40	61.39	-	-	9.60	138.77	122.82	216.58	245.10
Sevvaipettai	-	47.60	40.94	-	-	6.40	92.52	81.88	144.38	163.40
Anandur	-	39.69	-	-	-	-	119.65	9.97	26.54	175.66
Sirunagudi	-	59.54	-	-	-	-	179.47	14.96	39.82	263.49
Pullamadai	-	645.00	-	-	-	15.00	293.66	139.15	849.50	277.07
Sattanur	-	108.00	-	-	-	-	225.19	230.53	113.08	458.15
Arunuthimangalam	-	57.31	15.20	-	73.24	40.88	127.62	78.44	75.78	132.04
Odaikkal	-	67.92	29.70	-	-	4.00	5.00	80.05	221.93	44.35
Paranur	-	336.16	-	-	-	7.79	3.36	307.99	439.18	301.27
Thiruthervalai	17.00	23.25	-	-	-	9.00	176.39	58.69	224.72	194.39
Ayangudi	-	53.53	9.60	-	-	3.80	286.48	126.18	478.80	291.46

Gram Panchayat	Land Resources (ha)									
	Area under Forest land	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing 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
Gudalur	-	258.56	62.40	-	-	-	-	-	502.46	202.38
Vadakalur	-	99.45	24.00	-	-	-	-	-	193.26	77.84
Kadalur	-	498.74	40.91	-	-	2.55	3.58	126.09	169.83	253.04
Kavanoor	-	421.77	21.07	-	15.00	49.50	405.99	158.02	398.17	497.05
Kothaidal	-	62.25	-	-	-	0.38	-	61.79	72.11	63.23
Kallikudi	-	481.08	0.30	-	-	12.00	-	144.38	118.01	337.62
Kavanakottai	-	133.31	-	-	-	13.00	225.00	188.69	592.12	272.02
Sanavelli	-	30.07	-	-	116.00	-	336.30	59.82	404.47	347.79
Karungudi	-	22.96	4.20	-	-	35.20	384.90	111.63	357.02	430.79
Pitchanakurichi	-	33.44	30.80	-	-	-	421.14	36.64	143.95	255.53
Kottagudi	-	160.40	11.40	-	54.93	30.66	167.37	135.87	152.63	281.94
A.Manakudi	2.10	393.28	14.33	3.80	-	126.70	10.51	342.58	157.77	219.92
Melapanaiyur	-	125.61	-	-	29.09	-	15.32	94.84	149.41	197.71

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Radhanur	17.83	-	1,760.31	580.80	306.77	875.37	871.04	298.97
Tiruppalaikkudi	72.00	12.00	624.39	164.10	48.01	209.48	243.92	47.75
Chiituruvadi	210.00	17.00	1,231.00	243.92	301.86	540.78	365.87	298.61
Alagarthevankottai	428.89	0.71	930.45	516.37	370.79	884.56	774.21	369.83
Karkathakudi	231.41	0.16	2,996.38	238.73	571.42	810.15	358.09	571.42
Thumbadakottai	226.00	-	1,288.40	558.77	384.44	941.48	837.39	384.10
Sethidal	203.06	4.43	922.31	52.97	650.03	580.63	66.51	611.73
Urangudi	66.72	0.05	282.00	66.45	207.85	274.30	99.68	207.85
Sholandur	102.08	-	590.27	205.10	240.74	445.25	307.65	240.48
Senkudi	70.29	-	421.42	48.66	201.10	230.94	66.87	196.60
Varavani	29.71	-	1,068.40	84.23	445.92	465.82	108.57	426.30
Govindamangalam	132.79	9.60	723.27	407.75	388.05	795.80	611.63	388.05
Sevvaipettai	88.54	6.40	482.18	407.75	388.05	795.80	611.63	388.05
Anandur	39.69	-	331.82	434.00	94.49	528.49	651.00	94.49
Sirunagudi	59.54	-	497.74	434.00	94.49	528.49	651.00	94.49
Pullamadai	645.00	15.00	1,559.38	313.67	880.25	1,127.15	456.53	861.73
Sattanur	108.00	-	1,026.95	454.89	139.90	558.82	682.34	127.31
Arunuthimangalam	72.51	114.12	413.88	427.00	360.76	787.16	640.50	360.55
Odaikkal	97.62	4.00	351.33	22.09	137.39	158.85	33.14	137.10
Paranur	336.16	7.79	1,051.80	7.35	128.91	136.25	11.02	128.91
Thiruthervalai	40.25	9.00	654.19	264.44	326.31	590.75	396.66	326.31
Ayangudi	63.13	3.80	1,182.92	209.89	408.65	618.54	314.84	408.65
Gudalur	320.96	-	704.84	308.20	775.33	1,083.53	462.30	775.33
Vadakalur	123.45	-	271.10	308.20	775.33	1,083.53	462.30	775.33
Kadalur	539.65	2.55	552.54	367.20	296.49	663.69	550.80	296.49
Kavanoor	442.84	64.50	1,459.23	425.94	465.73	891.66	638.90	465.73

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Kothaidal	62.25	0.38	197.13	425.94	465.73	891.66	638.90	465.73
Kallikudi	481.38	12.00	600.01	337.17	182.46	519.62	505.75	182.46
Kavanakottai	133.31	13.00	1,277.83	330.00	580.80	889.30	494.68	568.34
Sanavelli	30.07	116.00	1,148.38	427.00	360.76	787.16	640.50	360.55
Karungudi	27.16	35.20	1,284.34	489.96	411.74	901.69	734.93	411.74
Pitchanakurichi	64.24	-	857.26	288.59	308.09	596.68	432.88	308.09
Kottagudi	171.80	85.59	737.81	330.25	269.75	600.00	495.38	269.75
A.Manakudi	409.71	130.50	730.78	200.98	264.92	465.90	301.47	264.92
Melapanaiyur	125.61	29.09	457.28	303.00	224.00	527.00	454.50	224.00

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
Radhanur	8.95	91.05	-	-	-	1.17	24.90	45.91	28.02	-	73.00	27.00
Tiruppalaikkudi	42.65	57.35	-	-	-	16.18	79.41	1.47	-	2.94	51.00	49.00
Chiituruvadi	-	100.00	-	-	-	1.68	98.32	-	-	-	60.00	40.00
Alagarthevankottai	0.52	99.48	-	-	-	17.19	82.81	-	-	-	67.00	33.00
Karkathakudi	11.03	88.97	-	-	-	9.51	82.51	7.98	-	-	50.00	50.00
Thumbadakottai	11.92	88.08	-	-	-	18.46	81.54	-	-	-	48.00	52.00
Sethidal	3.37	96.63	-	-	-	-	13.48	69.66	16.85	-	68.00	32.00
Urangudi	-	100.00	-	-	-	-	82.14	17.86	-	-	83.00	17.00
Sholandur	-	100.00	-	-	-	1.08	69.78	29.14	-	-	67.00	33.00
Senkudi	-	100.00	-	-	-	-	39.58	60.42	-	-	66.00	34.00
Varavani	24.68	75.32	-	-	-	-	-	1.30	92.21	6.49	57.00	43.00
Govindamangalam	41.21	45.60	-	13.19	-	-	2.75	49.45	47.80	-	71.00	29.00
Sevvaipettai	-	31.31	66.16	2.53	-	5.56	11.11	-	80.81	2.53	71.00	29.00
Anandur	41.21	45.60	-	13.19	-	-	2.75	49.45	47.80	-	66.00	34.00
Sirunagudi	41.21	45.60	-	13.19	-	-	2.75	49.45	47.80	-	66.00	34.00
Pullamadai	17.07	82.93	-	-	-	-	-	0.61	99.39	-	57.00	43.00
Sattanur	32.98	63.83	3.19	-	-	-	5.32	34.04	37.23	23.40	61.00	39.00
Arunuthimangalam	27.72	72.28	-	-	-	0.99	3.47	31.68	40.59	23.27	58.00	42.00
Odaikkal	-	54.55	45.45	-	-	4.55	-	-	95.45	-	75.00	25.00
Paranur	16.10	83.90	-	-	-	0.49	-	29.76	69.76	-	69.00	31.00
Thiruthervalai	0.72	76.81	22.46	-	-	1.45	-	6.52	86.96	5.07	67.00	33.00
Ayangudi	0.27	99.18	-	-	0.55	17.49	74.86	7.65	-	-	63.00	37.00
Gudalur	16.67	66.67	16.67	-	-	0.98	-	14.71	76.96	7.35	74.00	26.00
Vadakalur	16.67	66.67	16.67	-	-	0.49	-	14.71	77.45	7.35	74.00	26.00
Kadalur	9.60	90.40	-	-	-	-	46.89	53.11	-	-	64.00	36.00
Kavanoor	41.24	58.76	-	-	-	1.03	1.03	-	-	97.94	70.00	30.00

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
Kothaidal	0.98	98.54	-	-	0.49	16.10	83.90	-	-	-	69.00	31.00
Kallikudi	-	100.00	-	-	-	-	-	23.91	72.83	3.26	71.00	29.00
Kavanakottai	10.92	89.08	-	-	-	4.44	85.32	10.24	-	-	69.00	31.00
Sanavelli	0.50	99.50	-	-	-	27.72	72.28	-	-	-	58.00	42.00
Karungudi	16.43	75.64	7.93	-	-	5.67	12.18	5.67	62.89	13.60	63.00	37.00
Pitchanakurichi	-	99.36	0.64	-	-	-	49.04	50.32	0.64	-	68.00	32.00
Kottagudi	20.00	80.00	-	-	-	-	-	10.00	30.00	60.00	63.00	37.00
A.Manakudi	83.19	15.93	0.88	-	-	0.88	-	0.88	-	98.23	67.00	33.00
Melapanaiyur	20.00	80.00	-	-	-	2.76	73.10	24.14	-	-	74.00	26.00

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slighly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moder-ate, high)
Radhanur	-	2.00	48.00	47.00	2.00	-	1.00	-	-	55.00	3.00	Moderate
Tiruppalaikkudi	-	-	-	20.59	-	-	79.00	-	58.00	95.60	11.24	Moderate
Chiituruvadi	-	-	-	29.41	-	-	71.00	-	-	43.00	14.24	Moderate
Alagarthevankottai	-	-	-	57.81	-	-	41.67	-	-	72.00	13.22	Moderate
Karkathakudi	-	-	-	-	-	-	100.00	-	-	50.00	21.43	Moderate
Thumbadakottai	-	-	-	20.38	6.15	0.38	73.00	-	-	49.00	45.86	Moderate
Sethidal	-	-	-	34.83	13.48	2.25	49.44	-	-	88.87	9.85	Moderate
Urangudi	-	-	-	-	23.81	1.19	75.00	-	-	83.00	3.55	Moderate
Sholandur	-	-	-	100.00	-	-	-	-	-	66.00	18.96	Moderate
Senkudi	-	-	-	-	-	-	100.00	-	-	65.00	30.58	Moderate
Varavani	-	-	-	5.26	9.21	1.32	84.21	-	-	70.00	22.08	Moderate
Govindamangalam	-	-	18.00	6.00	1.00	-	74.00	1.00	-	47.00	1.00	Moderate
Sevvaipettai	-	-	18.00	6.00	1.00	-	74.00	1.00	-	70.00	11.00	Moderate
Anandur	-	-	-	13.00	23.00	2.00	62.00	-	-	58.00	-	Moderate
Sirunagudi	-	-	-	13.19	22.53	1.65	62.64	-	-	20.42	48.23	High
Pullamadai	-	-	-	0.61	2.44	-	96.95	-	-	78.00	0.18	Moderate
Sattanur	-	-	-	-	1.06	-	99.00	-	-	43.00	11.23	Moderate
Arunuthimangalam	-	-	-	1.98	2.97	-	95.00	-	-	47.00	14.18	Moderate
Odaikkal	-	-	-	-	-	-	100.00	-	-	28.00	45.53	High
Paranur	-	-	-	56.65	15.76	-	28.00	-	-	83.00	14.00	Moderate
Thiruthervalai	-	8.00	42.00	48.00	1.00	-	1.00	-	-	27.00	45.00	High
Ayangudi	-	-	-	22.68	22.40	-	55.00	-	-	61.00	15.47	Moderate
Gudalur	-	-	-	41.67	18.63	0.98	39.00	-	-	74.00	9.91	Moderate
Vadakalur	-	-	-	41.67	18.63	0.98	39.00	-	-	68.00	-	Moderate
Kadalur	-	-	-	40.68	32.77	1.13	25.42	-	-	29.00	19.85	Moderate
Kavanoor	-	-	-	2.06	13.40	-	84.54	-	-	57.00	15.91	Moderate

Gram Panchayat	Status of Physical condition of the soil (%)								Soil Texture (%)			
	Mod-erately Acidic	Strongly Acidic	Highly Acidic	Mod-erately Acidic	Slighly Acidic	Neutral	Mod-erately Alkaline	Strongly Alkaline	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moder-ate, high)
Kothaidal	-	-	-	56.65	15.76	-	28.00	-	-	64.00	18.85	Moderate
Kallikudi	-	-	-	28.26	13.04	-	59.00	-	-	54.00	11.47	Moderate
Kavanakottai	-	-	-	25.68	20.89	-	53.42	-	-	69.00	6.70	Moderate
Sanavelli	-	-	-	1.98	2.97	-	95.00	-	-	81.00	-	Moderate
Karungudi	-	-	-	23.23	23.23	-	54.00	-	-	68.00	4.40	Moderate
Pitchanakurichi	-	-	-	9.03	63.23	-	0.65	27.00	-	62.00	4.20	Moderate
Kottagudi	-	-	-	20.00	30.00	10.00	40.00	-	-	61.00	-	Moderate
A.Manakudi	-	-	-	53.98	23.89	4.42	17.70	-	-	70.00	1.13	Moderate
Melapanaiyur	-	-	-	9.72	1.39	-	-	90.00	-	44.00	19.47	Moderate

Gram Panchayat	Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)		Livestock (No.)			
	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population	Poultry
Radhanur	17	299.25	430.68	14	86	39	61	275	250	55	250
Tiruppalaikkudi	17	112.10	111.90	89	11	89	11	906	339	757	1,230
Chiituruvadi	17	212.16	308.35	92	8	99	1	339	772	143	400
Alagarthevankottai	17	158.30	410.58	89	11	100	-	309	265	528	523
Karkathakudi	17	509.41	1,515.21	68	33	97	3	261	148	178	396
Thumbadakottai	17	219.03	408.74	89	11	100	-	360	4	445	694
Sethidal	17	157.55	412.82	50	50	100	-	228	-	93	279
Urangudi	17	47.95	143.81	70	30	100	-	96	-	143	148
Sholandur	17	105.28	217.24	100	-	100	-	174	80	87	336
Senkudi	17	71.64	83.97	29	71	91	9	133	46	178	269
Varavani	17	181.63	345.65	79	21	92	8	231	228	93	264
Govindamangalam	17	67.16	206.23	31	69	67	33	505	120	88	168
Sevvaipettai	17	123.10	378.00	55	45	94	6	337	80	58	112
Anandur	17	67.05	91.58	55	45	94	6	164	-	193	165
Sirunagudi	17	84.62	158.33	55	45	90	10	246	-	193	165
Pullamadai	17	267.64	588.07	76	24	90	10	169	783	361	342
Sattanur	17	174.58	298.18	3	97	93	7	208	601	325	-
Arunuthimangalam	17	92.34	146.71	57	43	89	11	470	3	453	663
Odaikkal	17	65.46	139.00	50	50	98	2	40	650	520	120
Paranur	17	180.13	386.51	86	14	100	-	506	211	212	820
Thiruthervalai	17	182.58	560.11	24	76	91	9	320	-	407	366
Ayangudi	17	203.37	402.08	24	76	68	32	479	180	427	1,198
Gudalur	17	130.43	367.93	53	47	95	5	463	272	181	241
Vadakalur	17	50.17	141.51	62	38	98	2	178	105	70	93

Gram Panchayat	Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)		Livestock (No.)			
	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population	Poultry
Kadalur	17	101.32	220.74	89	11	98	2	356	-	414	623
Kavanoor	17	262.62	475.13	89	11	98	2	168	22	-	244
Kothaidal	17	33.58	70.65	89	11	95	5	76	32	32	123
Kallikudi	17	104.09	237.84	33	67	70	30	205	-	219	162
Kavanakottai	17	219.44	451.08	10	90	64	36	495	30	390	75
Sanavelli	17	214.94	453.23	69	31	94	6	655	200	1,556	1,298
Karungudi	17	225.04	411.24	69	31	79	21	1,189	379	114	431
Pitchanakurichi	17	150.97	208.53	52	48	87	13	329	96	192	2,198
Kottagudi	17	141.92	255.52	20	80	67	33	237	62	23	243
A.Manakudi	17	149.21	200.23	20	80	66	34	186	581	237	19
Melapanaiyur	17	82.68	196.38	62	38	97	3	151	-	73	96

ANNEXURE 3.11

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

Gram Panchayat	Geo-graphical Area (ha)	Male Popula-tion (No.)	Female Popula-tion (No.)	Total Popula-tion (No.)	SC Pop-ulation (No.)	Vul-nerable popu-pation (No.)	House-holds (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vul-nerable House-holds (SECC) (No.)	% of Vul-nerable House-holds (%)
Radhanur	1,778	1,247	1,155	2,402	334	334	666	5	37	15	2
Tiruppalaikkudi	708	4,142	4,682	8,824	3,647	3,648	1,676	23	53	32	2
Chiituruvadi	1,458	973	979	1,952	433	433	513	236	28	174	34
Alagarthevankottai	1,355	921	933	1,854	484	484	453	120	26	92	20
Karkathakudi	1,087	1,113	1,136	2,249	294	294	514	20	31	23	5
Thumbadakottai	1,514	1,300	1,301	2,601	645	645	629	62	28	52	8
Sethidal	1,130	919	880	1,799	162	162	437	104	27	81	19
Urangudi	349	528	550	1,078	425	425	415	2	4	3	1
Sholandur	692	864	866	1,730	907	907	406	7	25	12	3
Senkudi	449	657	627	1,284	411	411	315	12	18	14	4
Varavani	1,093	732	689	1,421	177	177	439	33	35	34	8
Govindamangalam	1,345	1,427	1,390	2,817	665	665	893	98	65	88	10
Sevvaipettai	682	1,427	1,390	2,817	665	665	893	98	65	88	10
Anandur	498	1,795	1,810	3,605	540	540	935	11	50	23	2
Sirunagudi	621	1,795	1,810	3,605	540	540	935	11	50	23	2
Pullamadai	2,204	1,820	1,814	3,634	263	265	843	41	55	45	5
Sattanur	1,033	1,820	1,650	3,470	236	236	440	46	37	43	10
Arunuthimangalam	601	2,565	2,463	5,028	1,065	1,065	1,181	398	59	296	25
Odaikkal	453	185	170	355	109	109	238	176	11	127	53
Paranur	1,339	113	129	242	15	15	112	3	13	6	5
Thiruthervalai	901	1,069	1,047	2,116	623	623	529	104	39	85	16
Ayangudi	1,257	452	478	930	141	141	249	39	24	35	14

Gram Panchayat	Geo-graphical Area (ha)	Male Popula-tion (No.)	Female Popula-tion (No.)	Total Popula-tion (No.)	SC Pop-ulation (No.)	Vul-nerable popu-pation (No.)	House-holds (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vul-nerable House-holds (SECC) (No.)	% of Vul-nerable House-holds (%)
Gudalur	1,042	1,414	1,279	2,693	290	290	784	23	36	27	3
Vadakalur	471	1,414	1,279	2,693	290	290	784	23	36	27	3
Kadalur	1,088	1,908	2,135	4,043	2,569	2,569	978	23	36	27	3
Kavanoor	2,457	486	515	1,001	83	83	265	15	3	11	4
Kothaidal	261	1,992	2,028	4,020	1,195	1,195	978	23	36	27	3
Kallikudi	936	585	624	1,209	302	302	324	40	14	32	10
Kavanakottai	1,374	311	327	638	72	72	179	6	15	9	5
Sanavelli	1,171	941	878	1,819	352	352	466	77	39	66	14
Karungudi	1,388	1,071	1,142	2,213	510	510	634	39	39	39	6
Pitchanakurichi	927	831	864	1,695	588	588	457	42	40	41	9
Kottagudi	1,058	2,759	2,658	5,417	1,705	1,705	893	98	65	88	10
A.Manakudi	1,324	694	765	1,459	328	328	441	26	8	21	5
Melapanaiyur	1,097	838	803	1,641	231	231	394	280	24	203	52

Gram Panchayat	Registered MGN-REGA Job cards (Persons)	Active person working in MGN-REGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha.m)
Radhanur	1,160	760	26	625	35	4
Tiruppalaikkudi	1,055	605	127	264	690	16
Chiituruvadi	648	476	10	-	669	4
Alagarthevankottai	642	504	34	470	165	3
Karkathakudi	718	402	45	560	721	4
Thumbadakottai	1,102	582	40	641	157	5
Sethidal	630	462	31	450	352	3
Urangudi	373	316	7	138	164	2
Sholandur	396	284	19	386	185	3
Senkudi	337	227	40	198	325	2
Varavani	735	585	27	300	220	3
Govindamangalam	790	433	58	200	342	5
Sevvaipettai	623	374	49	310	375	5
Anandur	397	258	42	750	300	7
Sirunagudi	499	327	38	265	75	7
Pullamadai	1,315	1,090	94	400	565	7
Sattanur	618	424	58	367	467	6
Arunuthimangalam	918	607	57	650	1,275	9
Odaikkal	281	223	37	402	417	1
Paranur	818	621	22	72	91	0
Thiruthervalai	671	409	39	510	259	4
Ayangudi	1,240	756	14	188	158	2
Gudalur	438	419	203	556	158	5
Vadakalur	480	344	26	325	-	5
Kadalur	899	660	21	352	25	7
Kavanoor	480	344	67	210	-	2
Kothaidal	356	187	18	120	222	7

Gram Panchayat	Registered MGN-REGA Job cards (Persons)	Active person working in MGN-REGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha.m)
Kallikudi	447	350	26	260	123	2
Kavanakottai	553	448	20	165	165	1
Sanavelli	819	660	146	430	1,063	3
Karungudi	1,142	721	40	539	89	4
Pitchanakurichi	606	339	48	340	152	3
Kottagudi	665	488	17	365	110	10
A.Manakudi	516	442	34	362	39	3
Melapanaiyur	578	340	22	390	326	3

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	Unirrigated Land	Treatment Area Irrigated by Source
Radhanur	-	0.30	-	-	-	-	0.64	18.06	5.29	12.79
Tiruppalaikkudi	-	0.83	19.55	-	-	10.20	7.59	0.24	0.97	3.13
Chiituruvadi	-	3.57	-	-	-	14.45	216.68	-	118.50	81.40
Alagarthevankottai	-	42.10	-	-	-	0.60	-	29.16	60.35	99.04
Karkathakudi	-	3.94	-	-	-	0.14	0.05	4.20	23.81	107.77
Thumbadakottai	-	3.85	-	-	-	-	38.95	1.48	18.78	43.86
Sethidal	-	3.46	-	-	-	3.77	0.02	24.32	135.29	11.12
Urangudi	-	1.14	-	-	-	0.04	-	0.07	0.41	1.32
Sholandur	-	1.24	24.65	-	-	-	1.41	3.81	6.24	6.25
Senkudi	-	1.20	-	-	-	-	5.35	5.08	4.58	1.85
Varavani	-	0.51	-	-	-	-	30.99	0.10	43.81	6.87
Govindamangalam	-	1.22	52.18	-	-	8.16	13.88	12.28	21.66	24.51
Sevvaipettai	-	0.81	34.80	-	-	5.44	9.25	8.19	14.44	16.34
Anandur	-	0.68	-	-	-	-	2.39	0.20	0.53	3.51
Sirunagudi	-	1.01	-	-	-	-	3.59	0.30	0.80	5.27
Pullamadai	-	49.74	-	-	-	12.75	14.68	6.96	42.48	13.85
Sattanur	-	1.84	-	-	-	-	22.52	23.05	11.31	45.82
Arunuthimangalam	-	0.98	12.92	-	62.25	34.75	32.02	19.68	19.01	33.13
Odaikkal	-	-2.89	25.25	-	-	3.40	2.66	42.55	117.96	23.57
Paranur	-	5.72	-	-	-	6.62	0.18	16.50	23.53	16.14
Thiruthervalai	6.80	0.40	-	-	-	7.65	28.22	9.39	35.96	31.10
Ayangudi	-	0.91	8.16	-	-	3.23	40.11	17.67	67.03	40.80
Gudalur	-	11.45	53.04	-	-	-	-	-	15.07	6.07
Vadakalur	-	4.41	20.40	-	-	-	-	-	5.80	2.34

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	Unirrigated Land	Treatment Area Irrigated by Source
Kadalur	-	108.47	34.77	-	-	2.17	0.11	3.78	5.09	7.59
Kavanoor	-	5.19	17.91	-	12.75	42.08	16.24	6.32	15.93	19.88
Kothaidal	-	2.10	-	-	-	0.33	-	1.85	2.16	1.90
Kallikudi	-	98.25	0.26	-	-	10.20	-	14.44	11.80	33.76
Kavanakottai	-	2.27	-	-	-	11.05	11.25	9.43	29.61	13.60
Sanavelli	-	0.51	-	-	98.60	-	47.08	8.37	56.63	48.69
Karungudi	-	0.39	3.57	-	-	29.92	23.09	6.70	21.42	25.85
Pitchanakurichi	-	0.57	26.18	-	-	-	37.90	3.30	12.96	23.00
Kottagudi	-	2.73	9.69	-	46.69	26.06	16.74	13.59	15.26	28.19
A.Manakudi	0.84	36.62	12.18	3.23	-	107.70	0.53	17.13	7.89	11.00
Melapanaiyur	-	0.56	-	-	24.73	-	7.66	47.42	74.71	98.85

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
Radhanur	2.12	-	-
Tiruppalaikkudi	14.25	1.45	-
Chiituruvadi	2.94	1.56	-
Alagarthevankottai	11.46	0.09	-
Karkathakudi	15.11	-	-
Thumbadakottai	23.53	-	-
Sethidal	4.66	0.53	-
Urangudi	9.65	-	-
Sholandur	14.56	-	2.06
Senkudi	1.71	-	1.97
Varavani	4.89	-	-
Govindamangalam	21.63	1.43	8.43
Sevvaipettai	15.23	0.95	5.62
Anandur	7.56	-	0.77
Sirunagudi	8.96	-	1.16
Pullamadai	24.47	1.20	23.75
Sattanur	21.96	-	11.97
Arunuthimangalam	10.23	13.77	-
Odaikkal	5.22	0.48	-
Paranur	4.76	0.94	-
Thiruthervalai	6.02	1.34	12.20
Ayangudi	7.04	0.56	19.31
Gudalur	17.74	-	2.47
Vadakalur	10.89	-	0.95
Kadalur	36.19	0.38	1.93
Kavanoor	8.92	9.59	6.80
Kothaidal	1.76	0.06	0.69
Kallikudi	27.26	1.78	7.00
Kavanakottai	4.49	1.93	7.45
Sanavelli	4.25	17.24	18.74
Karungudi	4.23	5.23	8.98
Pitchanakurichi	12.22	-	16.69
Kottagudi	6.40	12.72	8.60
A.Manakudi	15.52	19.40	4.26
Melapanaiyur	4.46	4.32	26.66

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.
A. Manakudi	39,042	50	45	-	-	5	86,156	111	-	-	5
Alagarthevankottai	33,680	42	1	1,146	4,585	8	483	1	-	-	8
Anandur	540	1	3	1,606	6,422	4	-	-	825	3,301	4
Arunuthimangalam	11,116	14	165	2,168	8,671	12	77,602	97	935	3,741	12
Ayangudi	7,257	9	50	610	2,439	12	2,584	3	-	-	12
Chitturuvadi	2,859	4	-	1,585	6,339	8	11,560	14	-	-	8
Govindamangalam	42,719	53	49	720	2,880	13	6,528	8	963	3,851	13
Gudalur	51,595	64	2	1,706	6,822	12	-	-	205	818	12
Kadalur	114,593	143	1	1,242	4,968	9	1,737	2	145	578	9
Kallikudi	78,805	99	58	2,089	8,356	5	8,160	10	319	1,275	5
Karkathakudi	3,151	4	-	1,046	4,182	7	109	0	-	-	7
Karungudi	3,169	4	45	1,468	5,870	30	23,936	30	266	1,063	30
Kavanakottai	1,815	2	75	463	1,851	12	8,840	11	816	3,262	12
Kavanoor	18,482	23	1	1,125	4,498	4	43,860	55	2,214	8,855	4
Kothidal	1,680	2	1	477	1,907	2	261	0	144	574	2
Kottagudi	9,936	12	54	1,753	7,012	6	58,201	73	152	609	6
Melapanaiyur	449	1	2	814	3,255	4	19,783	25	545	2,181	4
Odaikkal	17,882	22	-	1,095	4,379	1	2,720	3	917	3,666	1
Paranur	4,577	6	-	1,483	5,933	-	5,297	7	-	-	-
Pitchanakurichi	21,399	27	-	126	504	5	-	-	-	-	5
Pullamadai	39,793	50	39	2,176	8,704	4	10,200	13	871	3,482	4
Radhanur	243	0	142	858	3,431	7	-	-	398	1,591	7
Sanaveli	409	1	1	1,269	5,076	16	78,880	99	295	1,181	16
Sattanur	1,471	2	5	-	-	5	-	-	606	2,422	5
Senkudi	957	1	5	785	3,140	3	-	-	-	-	3

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	Plants	Area	No.	Length	No.
Sethidal	2,765	3	-	1,286	5,142	6	3,012	4	-	-	6
Sevvaipettai	28,486	36	3	1,846	7,382	8	4,352	5	841	3,364	8
Sholandur	20,715	26	-	1,342	5,366	4	-	-	965	3,859	4
Sirunagudi	811	1	1	270	1,079	6	-	-	-	-	6
Thiruthervalai	317	7	10	823	3,292	8	6,120	8	545	2,179	8
Thumbadakottai	3,077	4	-	1,651	6,605	9	-	-	472	1,886	9
Tiruppalaikkudi	16,307	20	8	1,081	4,323	23	8,160	10	-	-	23
Urangudi	908	1	-	522	2,088	2	34	0	229	916	2
Vadakalur	19,844	25	1	675	2,701	4	-	-	263	1,052	4
Varavani	405	1	3	-	-	6	-	-	383	1,530	6

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI		FD
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area	No.
A. Manakudi	5	10	37	10	9,929	50	-	-	7	18	15	37	5
Alagarthevankottai	8	36	189	36	8,420	42	1,135	4,540	38	94	75	189	8
Anandur	4	1	7	1	135	1	-	-	1	3	3	7	4
Arunuthimangalam	12	28	104	28	2,779	14	-	-	21	52	42	104	12
Ayangudi	12	50	166	50	1,814	9	1,030	4,120	33	83	66	166	12
Chitturuvadi	8	134	417	134	715	4	3,426	13,703	83	208	167	417	8
Govindamangalam	13	19	72	19	10,680	53	-	-	14	36	29	72	13
Gudalur	12	6	21	6	12,899	64	-	-	4	11	8	21	12
Kadalur	9	4	17	4	28,648	143	-	-	3	8	7	17	9
Kallikudi	5	10	60	10	19,701	99	456	1,824	12	30	24	60	5
Karkathakudi	7	11	136	11	788	4	-	-	27	68	54	136	7
Karungudi	30	20	77	20	792	4	212	849	15	39	31	77	30
Kavanakottai	12	20	64	20	454	2	800	3,198	13	32	26	64	12
Kavanoor	4	15	58	15	4,621	23	893	3,573	12	29	23	58	4
Kothidal	2	2	6	2	420	2	-	-	1	3	2	6	2
Kottagudi	6	18	74	18	2,484	12	436	1,745	15	37	30	74	6
Melapanaiyur	4	52	229	52	112	1	-	-	46	114	91	229	4
Odaikkal	1	65	187	65	4,470	22	153	610	37	93	75	187	1
Paranur	-	16	56	16	1,144	6	1,315	5,259	11	28	23	56	-
Pitchanakurichi	5	22	77	22	5,350	27	1,383	5,533	15	39	31	77	5
Pullamadai	4	26	78	26	9,948	50	2,320	9,280	16	39	31	78	4
Radhanur	7	10	37	10	61	0	1,919	7,677	7	18	15	37	7
Sanaveli	16	45	161	45	102	1	-	-	32	80	64	161	16
Sattanur	5	23	103	23	368	2	838	3,350	21	51	41	103	5
Senkudi	3	6	17	6	239	1	-	-	3	8	7	17	3
Sethidal	6	64	171	64	691	3	531	2,125	34	85	68	171	6
Sevvaipettai	8	13	48	13	7,121	36	-	-	10	24	19	48	8
Sholandur	4	5	18	5	5,179	26	-	-	4	9	7	18	4

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI		FD
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area	No.
Sirunagudi	6	2	10	2	203	1	378	1,510	2	5	4	10	6
Thiruthervalai	8	29	105	29	1,439	7	745	2,978	21	52	42	105	8
Thumbadakottai	9	24	103	24	769	4	983	3,933	21	52	41	103	9
Tiruppalaikkudi	23	4	12	4	4,077	20	126	503	2	6	5	12	23
Urangudi	2	-	2	-	227	1	-	-	-	1	1	2	2
Vadakalur	4	2	8	2	4,961	25	-	-	2	4	3	8	4
Varavani	6	30	82	30	101	1	-	-	16	41	33	82	6

Gram Panchayat	GSS	ICP		LDI		LP		MI		NADEP	ND		PS
	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.	Plants	HHs	No.
A. Manakudi	38	-	-	5	13	788	3,150	4	11	5	2,015	403	-
Alagarthevankottai	20	800	3,201	18	45	600	2,400	40	99	8	2,235	447	13
Anandur	19	414	1,654	1	2	413	1,650	1	4	4	4,165	833	4
Arunuthimangalam	11	446	1,784	14	35	1,275	5,100	13	33	12	5,750	1,150	17
Ayangudi	47	469	1,877	25	62	750	3,000	16	41	12	1,245	249	30
Chitturuvadi	23	-	-	67	168	375	1,500	33	81	8	2,580	516	10
Govindamangalam	12	321	1,284	10	24	825	3,300	10	25	13	3,710	742	4
Gudalur	25	528	2,111	3	8	563	2,250	2	6	12	3,410	682	6
Kadalur	41	303	1,211	2	4	563	2,250	3	8	9	4,890	978	16
Kallikudi	22	203	811	5	13	1,050	4,200	14	34	5	1,490	298	4
Karkathakudi	8	453	1,810	6	14	938	3,750	43	108	7	2,565	513	10
Karungudi	21	981	3,922	10	26	825	3,300	10	26	30	3,060	612	11
Kavanakottai	40	246	985	10	25	1,200	4,800	5	14	12	895	179	2
Kavanoor	1	317	1,269	8	19	825	3,300	8	20	4	1,325	265	6
Kothidal	4	283	1,133	1	2	150	600	1	2	2	4,990	998	3
Kottagudi	4	423	1,690	9	23	1,563	6,250	11	28	6	6,420	1,284	6
Melapanaiyur	7	763	3,050	26	65	750	3,000	40	99	4	1,970	394	2
Odaikkal	29	217	866	33	82	338	1,350	9	24	1	450	90	3
Paranur	5	-	-	8	20	450	1,800	6	16	-	380	76	-
Pitchanakurichi	2	-	-	11	27	-	-	9	23	5	2,310	462	-
Pullamadai	56	328	1,312	13	32	675	2,700	6	14	4	4,330	866	9
Radhanur	8	-	-	5	12	1,013	4,050	5	13	7	3,125	625	6
Sanaveli	161	449	1,795	22	56	900	3,600	19	49	16	2,230	446	32
Sattanur	48	262	1,049	11	28	750	3,000	18	46	5	1,835	367	-
Senkudi	19	100	398	3	8	225	900	1	2	3	1,525	305	7
Sethidal	2	424	1,696	32	80	450	1,800	4	11	6	2,155	431	7
Sevvaipettai	8	641	2,563	6	16	638	2,550	7	16	8	3,710	742	3
Sholandur	11	481	1,925	2	6	413	1,650	2	6	4	2,065	413	8

Gram Panchayat	GSS	ICP		LDI		LP		MI		NADEP	ND		PS
	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.	Plants	HHs	No.
Sirunagudi	19	617	2,469	1	2	563	2,250	2	5	6	4,165	833	4
Thiruthervalai	41	745	2,978	15	37	638	2,550	12	31	8	2,600	520	9
Thumbadakottai	11	775	3,099	12	30	863	3,450	18	44	9	3,145	629	17
Tiruppalaikkudi	27	-	-	2	4	1,013	4,050	1	3	23	9,150	1,830	31
Urangudi	4	317	1,267	-	0	263	1,050	1	1	2	1,535	307	4
Vadakalur	10	368	1,472	1	3	675	2,700	1	2	4	3,410	682	2
Varavani	8	80	320	15	37	413	1,650	3	7	6	1,925	385	7

Gram Panchayat	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	No.	No.	No.	No.	No.	Area	No.	No.	Length
A. Manakudi	12	9	-	2	2,584	3	4	40	-
Alagarthevankottai	4	12	-	2	-	-	4	45	3,201
Anandur	2	9		2			8	83	1,654
Arunuthimangalam	9	25	-	2	-	-	12	115	1,784
Ayangudi	6	14	-	2	-	-	2	25	1,877
Chitturuvadi	8	4		2			5	52	-
Govindamangalam	8	14		2			7	74	1,284
Gudalur	6	9	-	2	-	-	7	68	2,111
Kadalur	6	9	-	2	-	-	10	98	1,211
Kallikudi	12	16	-	2	-	-	3	30	811
Karkathakudi	5	20	-	2	-	-	5	51	1,810
Karungudi	12	10	-	2	-	-	6	61	3,922
Kavanakottai	6	13	-	2	-	-	2	18	985
Kavanoor	6	16	-	2	-	-	3	27	1,269
Kothidal	1	3		2			10	100	1,133
Kottagudi	10	15	-	2	-	-	13	128	1,690
Melapanaiyur	9	11	-	2	-	-	4	39	3,050
Odaikkal	2	7	-	2	-	-	1	9	866
Paranur	5	7	-	2	-	-	1	8	-
Pitchanakurichi	7	7	-	2	-	-	5	46	-
Pullamadai	2	16	-	2	-	-	9	87	1,312
Radhanur	12	15	1	2	-	-	6	63	-
Sanaveli	11	13		2			4	45	1,795
Sattanur	8	12	-	2	-	-	4	37	1,049
Senkudi	2	4		2			3	31	398
Sethidal	4	8	-	2	-	-	4	43	1,696
Sevvaipettai	6	11		2			7	74	2,563
Sholandur	3	8	-	2	-	-	4	41	1,925

Gram Panchayat	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	No.	No.	No.	No.	No.	Area	No.	No.	Length
Sirunagudi	8	7		2			8	83	2,469
Thiruthervalai	7	10	-	2	-	-	5	52	2,978
Thumbadakottai	3	20	-	2	-	-	6	63	3,099
Tiruppalaikkudi	1	15	-	2	-	-	18	183	-
Urangudi	1	6	-	2	-	-	3	31	1,267
Vadakalur	5	13	-	2	-	-	7	68	1,472
Varavani	3	8		2			4	39	320

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 23-02-2022
Aananthoor	2,188	188
Aayingudi	1,208	-
Alagarthevankottai	1,253	-
A. Manakkudi	1,242	238
A. R. Mangalam	2,600	466
Chitthoorvadi	1,530	11
Govindamangalam	1,777	-
Gudaloor	1,090	134
Kadalur	2,133	-
Kallikkudi	1,512	221
Karkatthakudi	998	-
Karungudi	2,345	463
Kavanakkottai	1,139	165
Kavanoor	1,320	452
Kothidal_Kalakkudi	1,162	12
Kottakudi	2,027	-
Melpanaiyur	1,358	171
Odaikkaal	1,100	264
Paaranur	530	-
Pichangurichi	1,583	201
Pullamadai	2,224	-
Rathaanur	1,752	255
Sanaveli	1,328	-
Satthanur	1,266	83
Sengudi	541	60
Sethidal	1,182	-
Sevvaipettai	1,702	-
Sholandur	1,140	134
Sirunagudi	1,317	94
Thiruppalaikkudi	4,078	465
Thirutthervalai	2,437	4
Thumbadaikkakottai	1,961	2
Uranangudi	393	-
Vadakkalur	1,611	46
Varavani	1,612	219

ANNEXURE 7.2

GP WISE ONGOING WORKS IN R S MANGALAM BLOCK

GP	Work Category	Ongoing works
A. Manakudi	Water Conservation and Water Harvesting	1
A.R.Mangalam	Water Conservation and Water Harvesting	2
Aananthoor	Water Conservation and Water Harvesting	2
Aayingudi	Drought Proofing	2
	Works on Individuals Land (Category IV)	9
Alagarthevankkottai	Drought Proofing	1
	Rural Sanitation	1
	Water Conservation and Water Harvesting	1
Chitthoorvadi	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
Govindamangalam A/B	Land Development	1
Gudaloor	Water Conservation and Water Harvesting	3
Kadalur	Water Conservation and Water Harvesting	2
Kallikkudi	Water Conservation and Water Harvesting	2
Karkatthakudi	Water Conservation and Water Harvesting	2
Karungudi	Water Conservation and Water Harvesting	2
Kavanakottai	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
Kavanoor	Water Conservation and Water Harvesting	2
Kothidal_Kalakkudi	Water Conservation and Water Harvesting	1
Kottakudi	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	7
Melpanaiyur	Rural Sanitation	1
	Water Conservation and Water Harvesting	2
Odaikkaal	Water Conservation and Water Harvesting	1
Paaranur	Drought Proofing	2
Pichangurichi	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Pullamadai	Water Conservation and Water Harvesting	2
Rathaanur	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Sanaveli	Water Conservation and Water Harvesting	2
Sattanur	Water Conservation and Water Harvesting	3
Sengudi	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
Sethidal	Water Conservation and Water Harvesting	2
Sevvaipettai	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Sholandur	Drought Proofing	2

GP	Work Category	Ongoing works
Sirunagudi	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	24
Thiruppalaikkudi	Water Conservation and Water Harvesting	2
Thirutthervalai	Water Conservation and Water Harvesting	1
Thumbadaikkakottai	Water Conservation and Water Harvesting	2
Vadakkalur	Water Conservation and Water Harvesting	2
Varavani	Water Conservation and Water Harvesting	2

ANNEXURE 8

CWRM KEY INDICATORS FOR GPs IN UPPUR CHATHIRAM MICRO-WATERSHED

CWRM Parameter	Chiituruvadi	Kadalur
Soil Resources: Status of Available Nitrogen (%)		
Very Low	0.00	9.60
Low	100.00	90.40
Status of Organic Carbon (%)		
Very Low	1.68	0.00
Low	98.32	46.89
Medium	0.00	53.11
Status of Soil Micro Nutrients (%)		
Sufficient	60.00	64.00
Deficient	40.00	36.00
Status of Physical condition of the soil (%)		
Moderately Acidic	29.41	40.68
Slighly Acidic	0.00	32.77
Neutral	0.00	1.13
Moderately Alkaline	71.00	25.42
Strongly Alkaline	0.00	0.00
Soil Texture (%)		
Fine Soil	43.00	29.00
Coarse loamy	14.24	19.85
Soil Water Permeability (Low, Moderate, high)	Moderate	Moderate
Soil moisture and ET		
Volumetric Soil Moisture (%)	17	17
Estimated Soil Moisture (ha.m)	212.16	101.32
ET Losses (ha.m)	308.35	220.74
Means of Water Extraction (%)		
Gravity	92.31	89.00
Lifting	8.00	11.00
Irrigation Methods (%)		
Wild Flooding	99	98
Control Flooding	1	2
Livestock (No.)		
Cattle Population	339	356
Sheep Population	772	0
Goat Population	143	414
Poultry	400	623
Land Resources (ha)		
Non-Agricultural Uses	210.00	498.74
Area under Barren & Un-cultivable Land	0.00	40.91
Cultivable Waste Land	17.00	2.55
Fallows Land other than Current Fallows	640.29	3.58
Current Fallow land	0.00	126.09
Unirrigated Land	350.17	169.83
Area Irrigated by Source	240.54	253.04

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