Ministry of Rural Development Ministry of Jal Shakthi

WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

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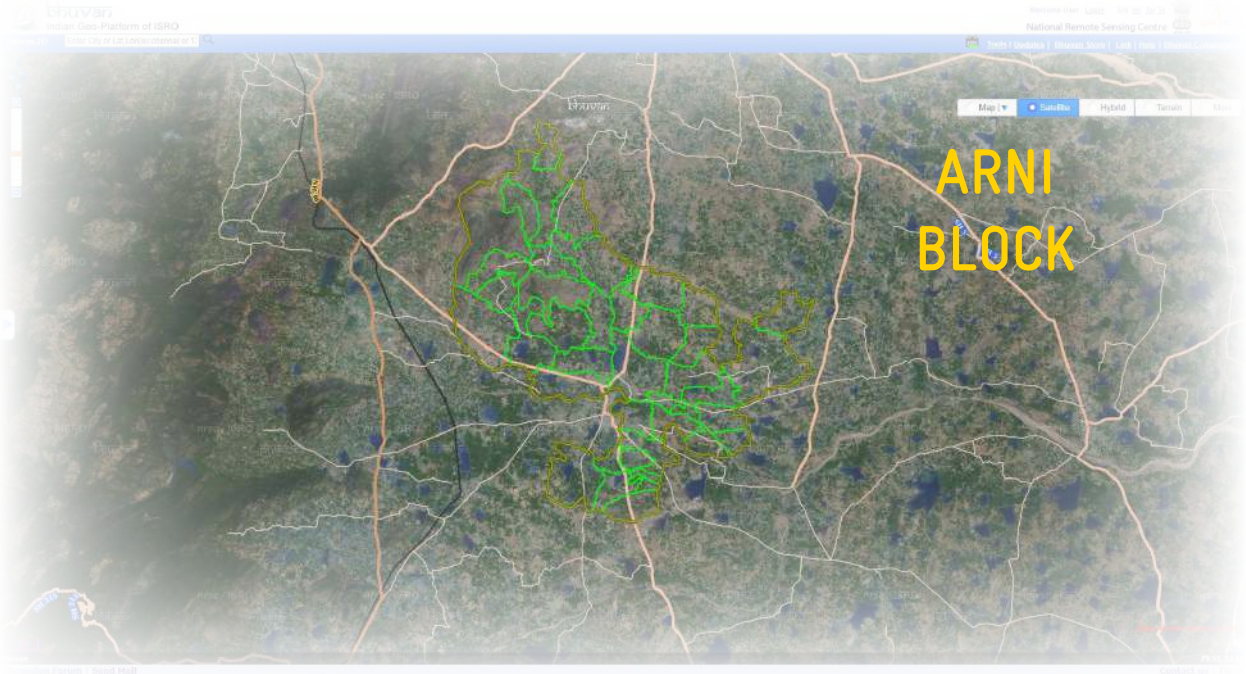


Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

District Rural Development Agency, Tiruvannamalai &
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

FOREWORD

Thiru. B. Murugesh, IAS
District Collector,
Tiruvannamalai

Tiruvannamalai is the second largest district in Tamil Nadu. The topography of Tiruvannamalai is almost plain sloping from west to east. Tiruvannamalai experiences hot and dry weather condition throughout the year. It is dry land region where farmers cultivate a single crop groundnut and some part of the district cultivate paddy coinciding north east monsoon. Groundwater plays an important role in the food production of the district. Ground water level and water quality ground water discharge and recharge are critical aspects of climate change. 85 % cultivation area of the district is met through groundwater.

All eighteen Blocks in the district are categorized as over exploited or critical as per latest state reports on groundwater status. Mahatma Gandhi NREGA is key scheme in the district, providing unskilled wage employment, asset creation for poor and marginal. The district has implemented in campaign mode in convergence, farm pond construction.

> "GIS based planning in 860 GPs, works identified under CWRM are verified, approved at Gram Sabha"

To enhance scientific works identification in MGNREGS, with technical support of GIZ under WASCA bilateral project, the Composite Water Resource Management (CWRM) approach is used for analyzing various parameters including spatial and temporal changes and also technique to provide solution for improving the four water (Ground water, Surface water, Rain water and Soil Moisture).

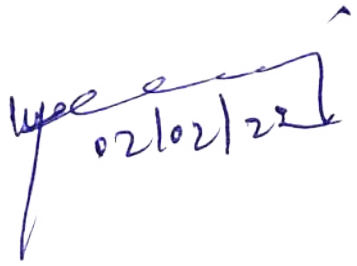
Through GIS based planning in 860 GPs, works identified under CWRM are verified, approved at Gram Sabha. These works would potentially reduce 38% surface runoff to be harvested or recharged by various interventions through ridge to valley watershed approach.

Hence, the developed CWRM plan at GP level would help to improve the statues of Water,Socio Economic, Climate, and Agricultural parameters in the district. The developed GP level plan by using CWRM is an integrated approach covering NRM (Narural Resource Management) and non NRM works.

The Innovative approach of climate Resilient measures (CRM) is helping the district to mitigate the cli-

mate hazard. The micro level systematic planning at GP level really brings a change in the climate aspects in the district. Water is the key factor for all development works, increasing the ground and surface water capacity would boost the economy and enhance climatic condition throughout the district.

Hence, all the GPs plans are analyzed, synthesized with mapping of SDG goals, INDC contributions to climate change in form of Block level report. The Block level reports really help rural development department and other convergence departments to do the systematic planning by using the data and technique. Wishes the contributors who have involved in bringing out this report for district development.



Thiru. B. Murugesh, IAS
District Collector,
Tiruvannamalai

MESSAGES

Thriu. M .Prathap, IAS
Additional Collector (Development) /
Project Director, DRDA

The present climate change crisis is inextricably linked to water. It induces extreme weather events, reduces the predictability of water availability, decreases water qualityand threatens sustainable development, biodiversity and enjoyment of the human rights to safe drinking water and sanitation. Building resilience towards Water Security and Climate Adaptation is inevitable for an integrated water resource management which WASCA is targeting. WASCA pilot study started in the district during January 2019 with developing inclusive Composite Water Resources Management (CWRM) plans for all GPs in this district. It also supported in building the capacity of the Engineers in GIS based planning adopting. The district officials with the technical support of WASCA Resourcecenter in the district has completed the CWRM plans for all theGPs. The CWRM plans assessed both the supply and demand a water budget at GP level. The prepared suitable key actions are identified for the development of public and common land, agriculture and allied activities and rural infrastructureat GP level through scientific process including hydrological, agricultural and socio economic perspectives. These GP plans are verified at the ground level by the Block and GP officials of DRDA and are consolidated at Block and district levels for prioritizing the actions and planning. The expected outcome of the WASCA project on completion will form a major chunk of DRDA of districts water security particularly the works related to cascade tank development, fallowland development, roof rain water harvesting, watershed works for treating drainage lines,improving dry lands with farm trench cum bund, farm ponds, pasture development,Block plantation with soil conservation. This demonstration project on water security and climate adaptation and its convergence approach at Panchayat level could be scaled-up and replicated. Subsequently, the Block level reports are envisioned to water resources planners and other stakeholders works on challenges of adapting to climate change with a portfolio of potential actions to reduce vulnerability. I assure this booklet of good practice example will guide the best adaptation practices towards climate resilience. I wish the entire team, stakeholders, experts, technical people involved in generating this good learning practice.

> **Block level reports are envisioned to water resources planners and other stakeholders works on challenges of adapting to climate change**

M. P—H

Thriu. M .Prathap, IAS
Additional Collector (Development) /
Project Director, DRDA

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) frame works 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 - H

DLSC
District Level Steering Committee

DLT
Drainage Line Treatment

DRD&PR
Department of Rural Development & Panchayat Raj

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

ha
Hectare

I - M

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

LULC
Land use and land cover

M - N

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

NAPCC
National Action on Climate Change

N - S

NARP
National Agricultural Research Project

NADEP
Nadepkaka

NDC
Nationally Determined Contributions

NEM
North-East monsoon

NGO
Non-Governmental Organization

NITI
National Institution for Transforming India

No.
Number

NRM
Natural Resource Management

NRSC
National Remote Sensing Centre

NWC
National Water Commission

PWD
Public Works Department

Rabi crop
Sown in winter and harvested in monsoon

S - U

RDPR
Rural Development & Panchayat Raj

RF
Reserve Forest

RTRWHS
Roof top rain water harvesting structures

RWHS
Rain Water Harvesting System

SAPCC
State Action Plan on Climate Change

SC
Scheduled Caste

SDG
Sustainable Development Goal

SDMA
State Disaster Management Authority

SDMRI
Suganthi Devadasan Marine Resources Institute

SECC
Socio Economic and Caste Census

SHG
Self Help Group

S - W

SLSC
State Level Steering Committee

ST
Scheduled Tribe

SWM
South-West monsoon

UN
United Nations

SW
Surface Water

TN
Tamil Nadu

WASCA
Water Security and Climate Adaptation

WCWH
Water Conservation and Water Harvesting

வான்நின்று உலகம் வழங்கி வருதலால்
தான்அமிழ்தம் என்றுணரற் பாற்று

குறள் - 11

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

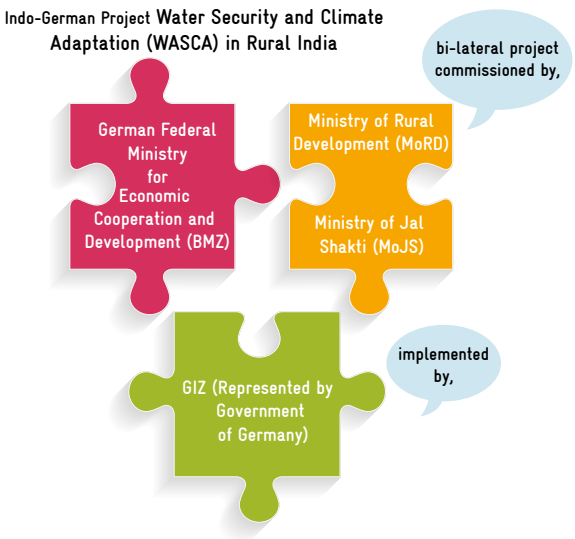
Thirukkural - 11

EXECUTIVE SUMMARY

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

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

The Indo-German Project "Water Security and Climate Adaptation in Rural India" (WASCA), is a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) in 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 the 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 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

Arni Block of Thiruvannmalai District lies between 12°36'52.054"N to 12°49'17.542"N latitude 79°12'23.608"E to 79°23'35.291"E longitude. The Block is surrounded by West Arani and Cheyyar Blocks (Figure 1.1). The total geographical area of this Block is 21,784.73 ha (217.84 Sq.km). Administratively, this Block comes under Arni taluk, with 38 Gram panchayats and 203 habitations in it.

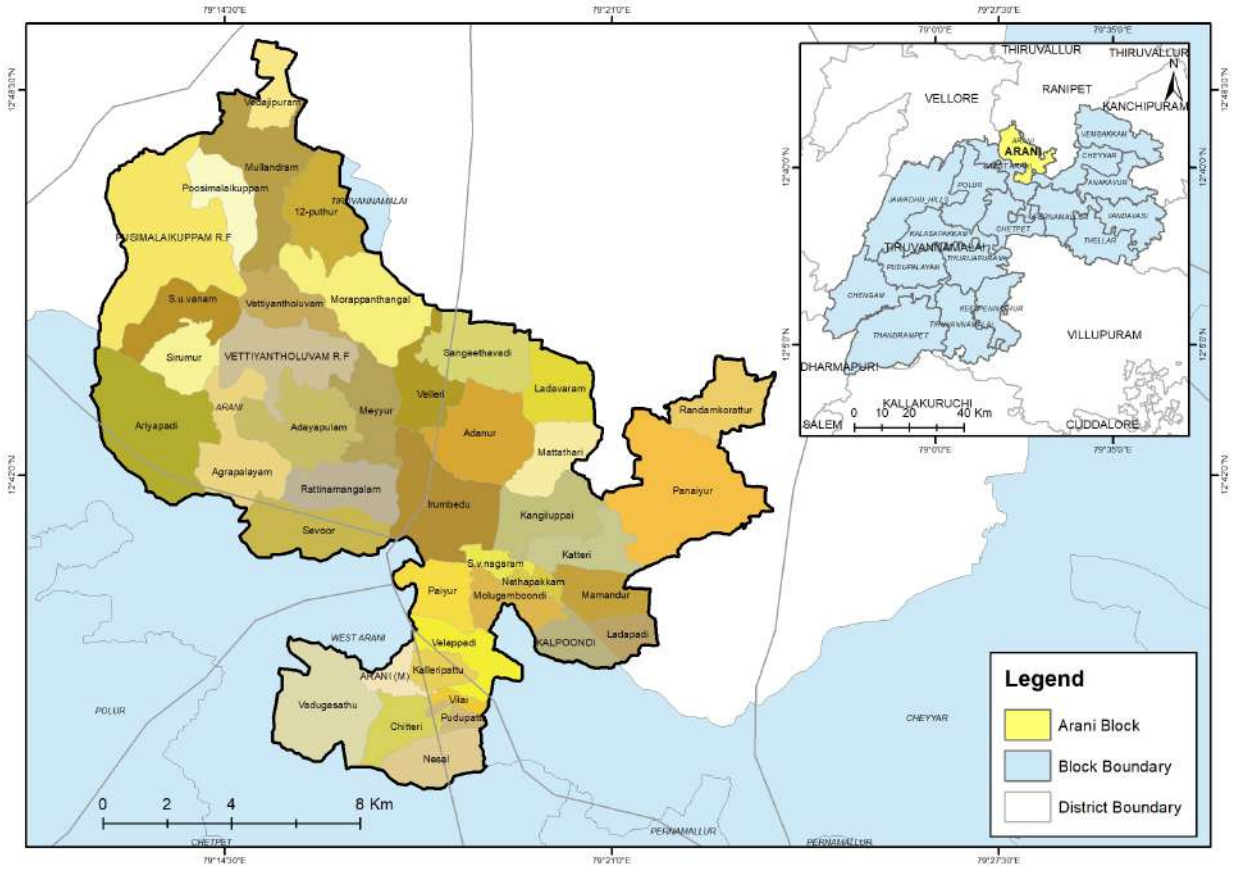


Figure 1.1. Arni Block and it's environ

According to Census 2011, the population of Arni Block is 1,15,884. The population density of the Block is 524 per Sq. km which is much higher than the District population density (473 per Sq. km) but lower than the State's density (555 per Sq.km). There is a 16.78% increase in the population observed since 2001 in this densely populated rural Block. The percentage of Male population is nearly equal to (50 %) female population (49.97%). The proportion of sex ratio is 999 females per 1000 males, which is slightly higher compared to the District average sex-ratio (994 females per 1,000 males). The literacy rate of female population is lower (44.02%) than male literacy (55.98%). At 79.12%, the average literacy rate of the Block is slightly higher than the national average (72.98%). Scheduled Castes and Scheduled Tribes accounted for 21.98% of the total population (Thiruvannamalai District profile 2020).

Economically, Arni Block is among the low revenue earning Blocks of the Tiruvannamalai District. Revenue for the Block is mostly generated from rice production and and Silk saree weaving, with a large community of silk weavers specializing in silk sarees. Paddy is the predominant crop, with 47.43 % of the irrigated area cultivated with paddy. The other major crops grown in the Block area are ground nut, other pulses and sugarcane.

> The proportion of sex ratio is 999 females per 1000 males, which is slightly higher compared to the District average sex-ratio (994 females per 1,000 males).

> At 79.12%, the average literacy rate of the Block is slightly higher than the national average (72.98%).

Under rainfed crops other pulses, ragi and mango are cultivated. Significant cultivated areas of banana, turmeric, dry chilli, coconut and other fruits and vegetables can also be seen. Groundnut and pulses are cultivated both under irrigated and rainfed conditions. A livestock count of 88,588 was recorded during 2019-20. The cattle count is 27,934 and the Block has 17 milk societies with 21,604 litres of milk being produced per day. A patch of (66 acres) of sericulture is practiced in the Block and 415 families are engaged in handloon weaving. The Famous Arni silk and a paddy variety named Arni Ponni, known for its rich aroma originates from Arni. Arni also is a major centre of Tamil Jainism.

> 47.43 % of the irrigated area cultivated with paddy.

Arni Block comes under Cheyyar sub-basin of Palar basin. K.N.River and Kalavai madurai river flows through the Block. The Block has 4 macro watersheds namely Cheyyar, Cheyyar River, Naganadi and RB Palar and 62 micro watersheds. (Figure 1.2).

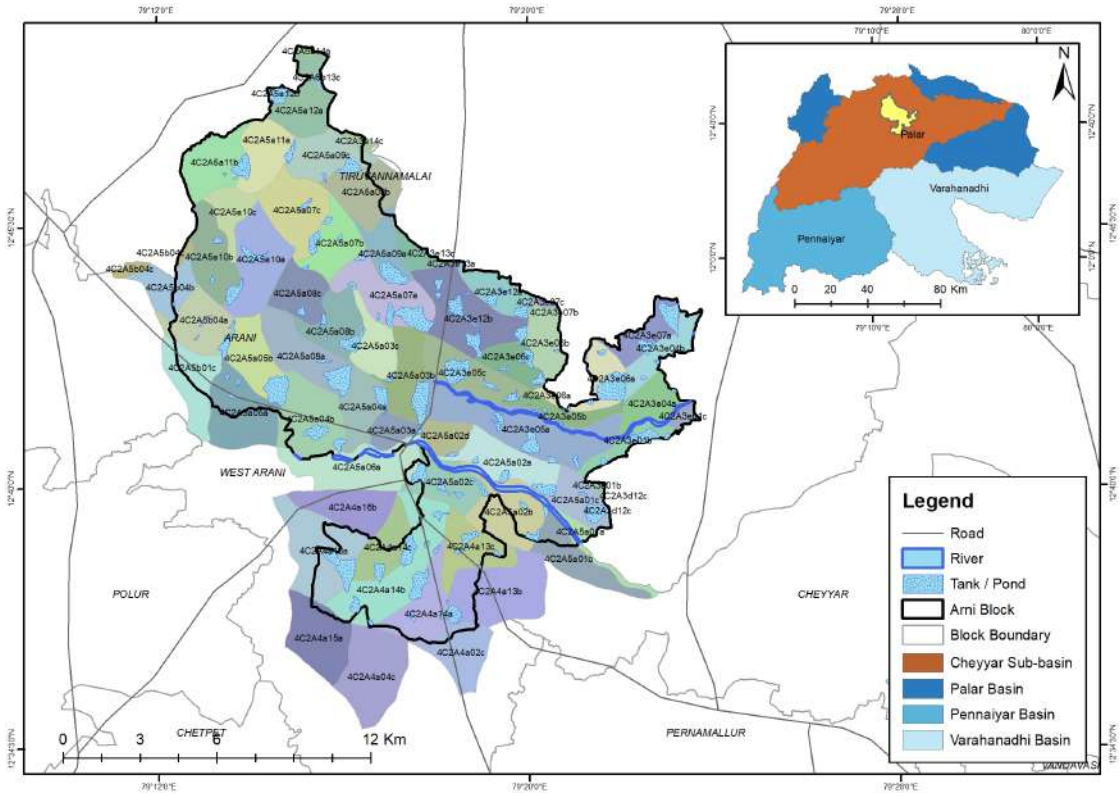


Figure 1.2. Watersheds- Arni Block

There are 105 tanks in the Block with the largest tank being the Irumbedu Tank with an area of 246.05 ha. Other important tanks are Panaiyur tank (237.15 ha), Adayapulam tank (171.11 ha), Villai Chitheri (167.95 ha) and Ariyapadi tank (138 ha) (Figure 1.3). The ground water levels in Arni Block is in an over exploited and semi critical state of depletion stage of ground water development. Arani, Agrapalayam, Sathyavijayanagaram firkas cover the Block. Arani firka is in an over exploited stage while Agrapalayam, Sathyavijayanagaram firkas are in a semi crtical stage.

GROUND WATER LEVEL OF THIS BLOCK

OVER EXPLOITED- › 100%	Arani
SEMI CRITICAL- › 70%&‹ 90%	Agrapalayam, Sathyavijayanagaram

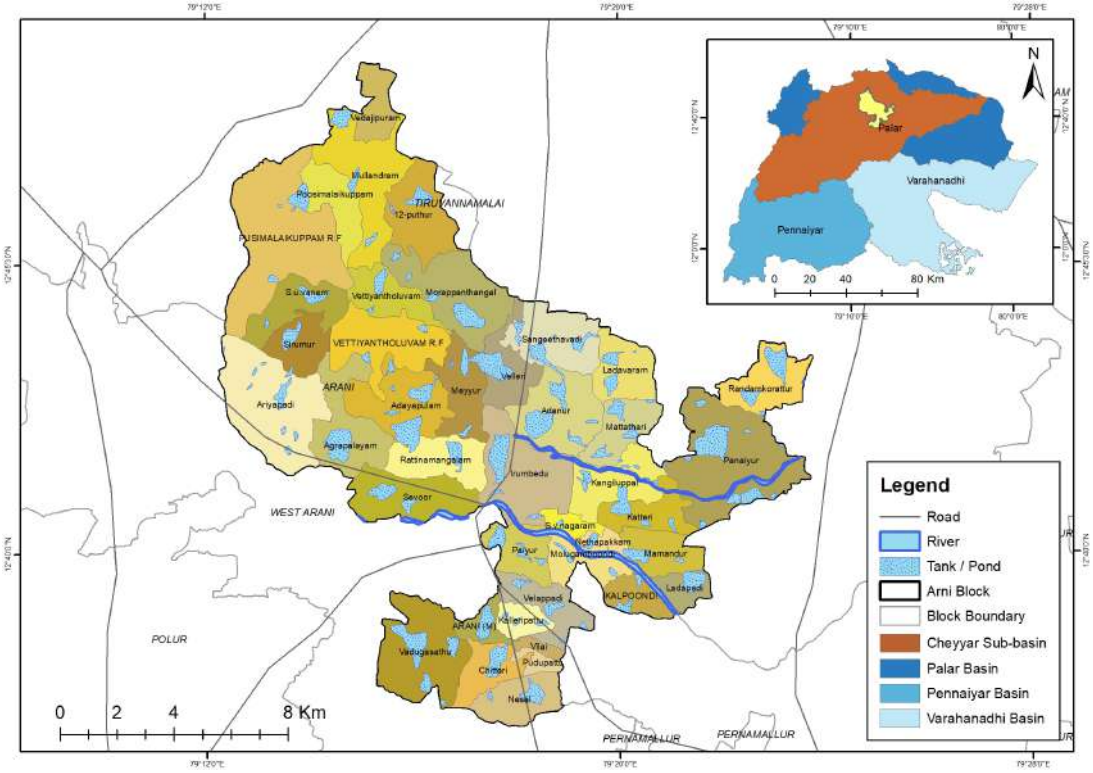
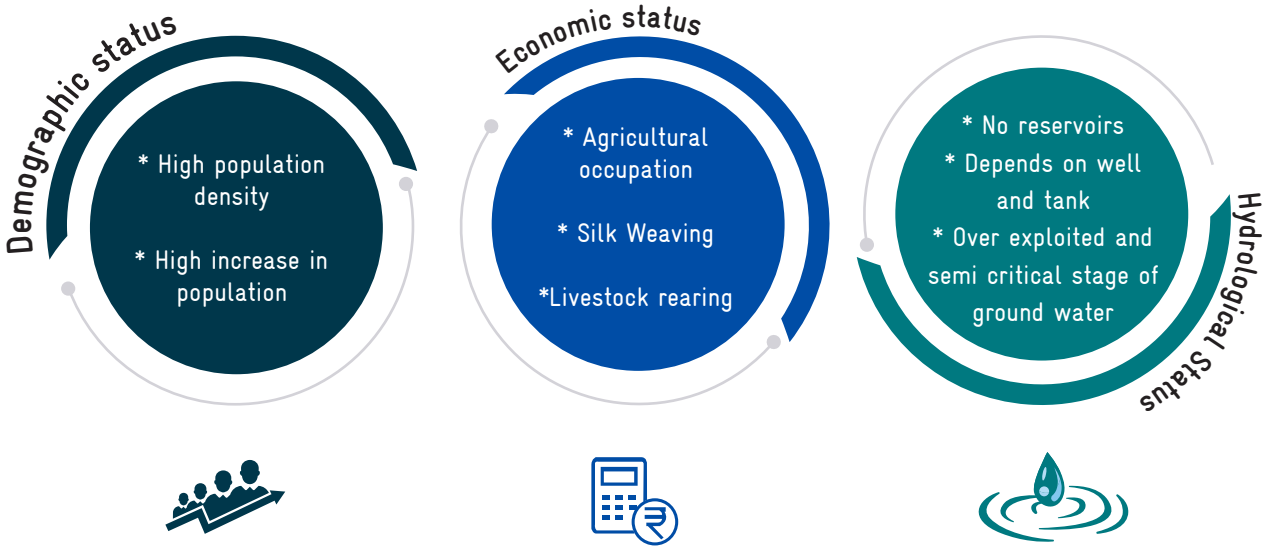


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

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

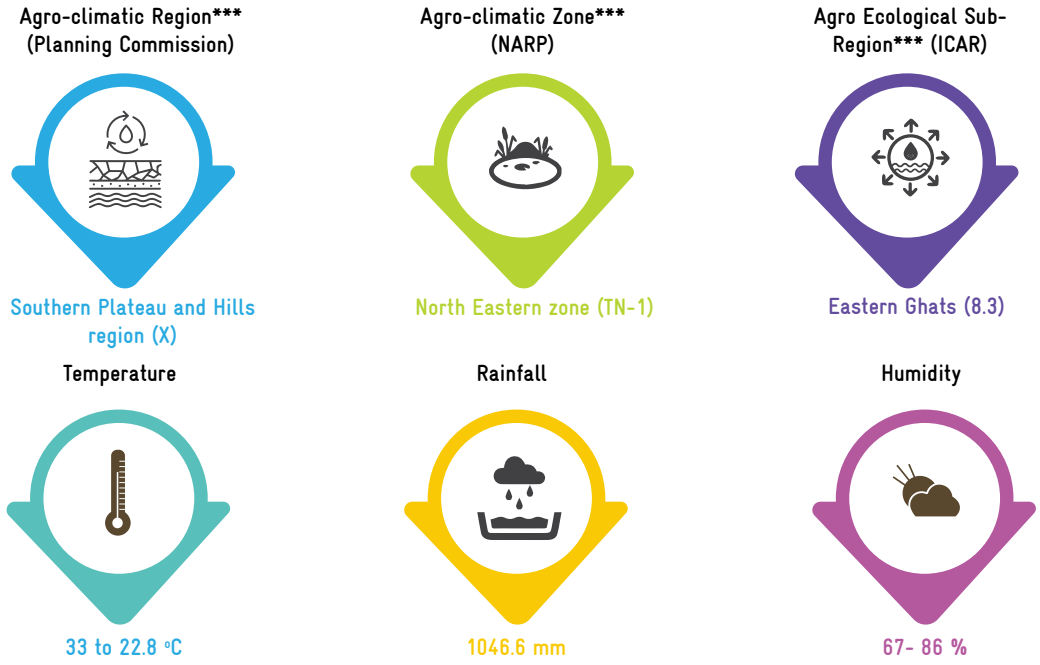
Thirukkural - 13

CHAPTER 2

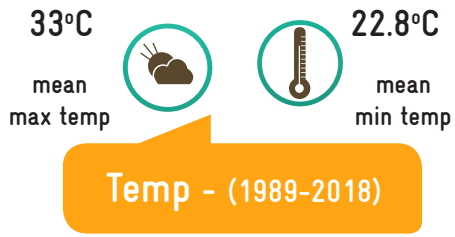
2 CLIMATE AND WATER SECURITY

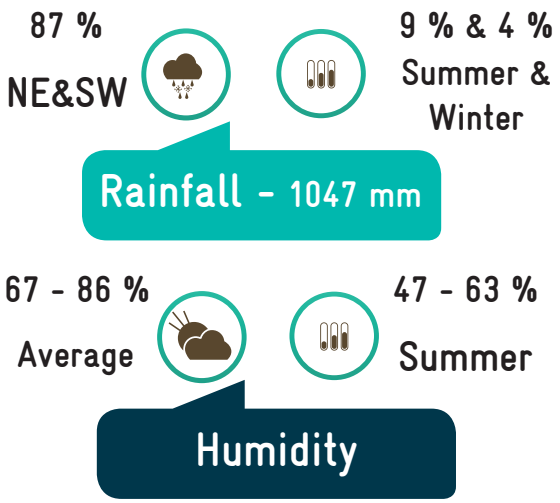
This region has typical tropical climate, located in the North Eastern agro-climatic zone of State and Southern Plateau and Hills region according to the agro climatic regional classification of planning commission. The general climate description of this region is given below (Table 1).

TABLE 1. GENERAL CLIMATE DESCRIPTION



In general, this semi arid region has dry and hot weather. The mean maximum temperature is 33°C and mean minimum temperature is 22.8°C during last 30 years (1989-2018) (IMD). In summer months the maximum temperature goes up to 45°C for few days. The average monthly temperature characteristic during 2020 is shown in Figure 2.1.





Normally this region receives major rainfall from North-East Monsoon (NEM) (October to December) and South-West Monsoons (SWM) (June to September). Past records show the annual average rainfall of this region is 1,047 mm (WRIS, GoI). Both North-East and South-West Monsoons contribute nearly 87 % of the annual rainfall in which SWM is slightly stronger. While summer (March to May) rainfall accounts for 9 % of the total rainfall and winter (January, February) season has low contribution (4%) to the annual rainfall (Figure 2.2). The average relative humidity is 67- 86 % and during summer it ranges between 47-63 %.

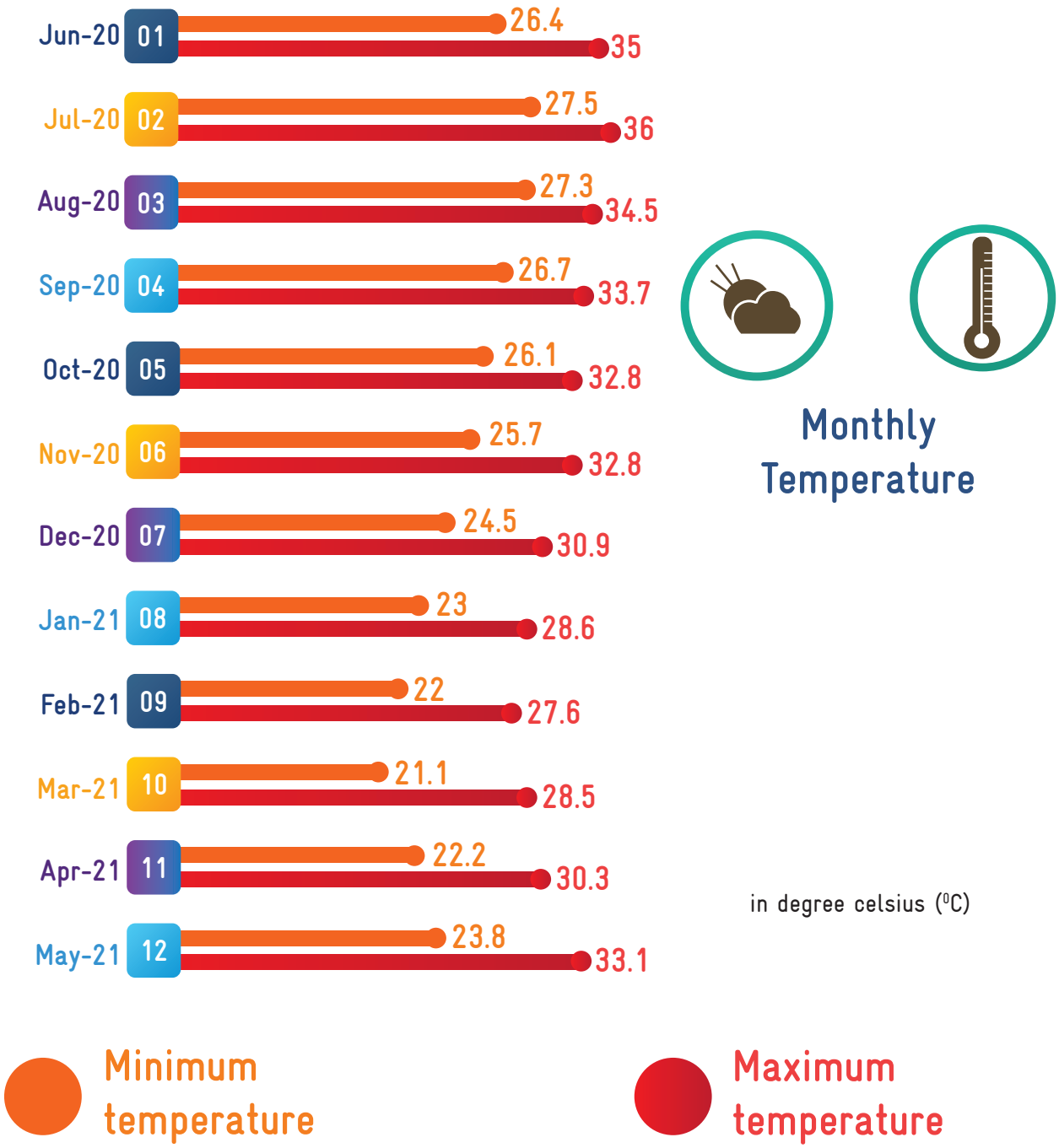


Figure 2.1. Average monthly temperature

The average annual rainfall days are 172 days in which 72 days are from NEM and 82 days are from SWM months. Onset of SWM rainfall starts in the 1st week of June and cessation would be in the 1st week of October. Onset of NEM rainfall starts in the 2nd week of October and cessation would be in the 4th week of December. Though the number of rainy days is slightly lesser than SWM, the intensity is more in NEM.

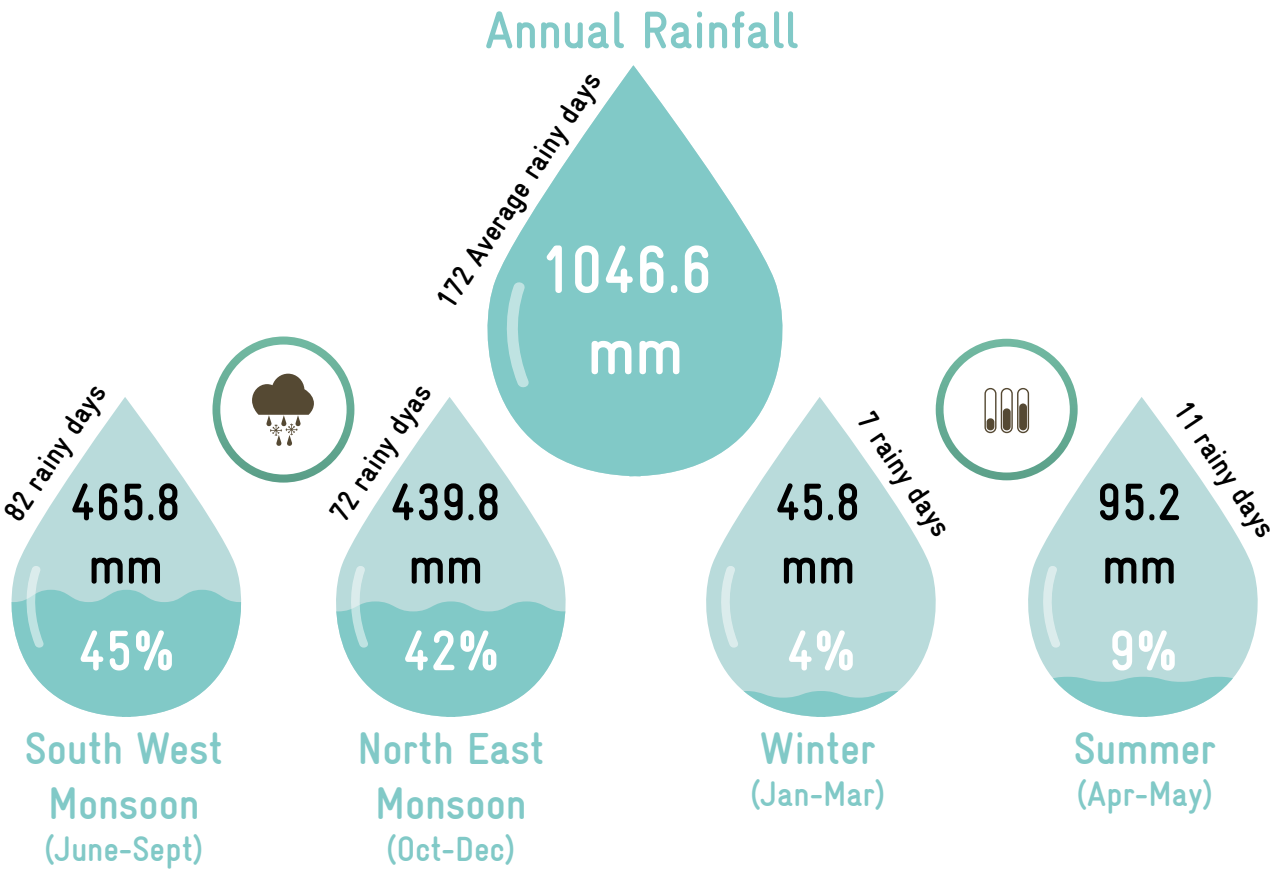


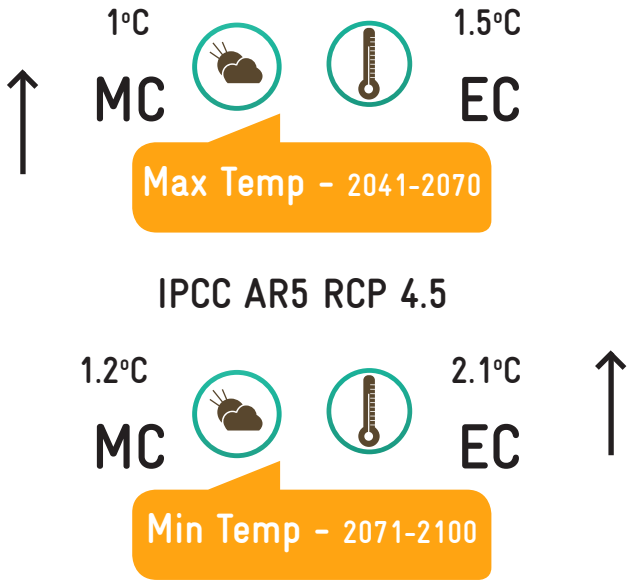
Figure 2.2. Season-wise distribution of annual rainfall

In recent decades, the world is witnessing significant changes in its climate. These changes include increase in average temperature, variations in the rainfall intensity and its frequency. This region is also no exception, and an increase in maximum and minimum temperature of 1.2°C and 0.5°C was observed during 1951 to 2015 (IMD). The rainfall variability is also well observed. During 1951 to 2015, there were 15 excess rainfall years (above normal rainfall) and 15 deficient rainfall years (below normal rainfall) recorded. The consecutive excess and deficient rainfall leads to rainfall variability and its extremities. Since this region is heavily dependent on monsoon rains, it is prone to droughts when the monsoons fail. As rainfall is the major source for determining water storage, existing water resources such as rivers, dams and 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 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°C increase in maximum temperature in mid-century (MC) period (2041-2070) and 1.5°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 1.2°C and 2.1°C during MC and EC periods. Average annual rainfall for IPCC AR5 RCP4.5 scenarios is projected to increase about 13 % towards MC and increase by about 21% towards EC period.



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

* surface and ground water availability
* river flow
* water quality
* soil moisture
* evapo-transpiration

* 1.2°C increase in maximum temperature during 1951-2015
* 0.5°C increase in minimum temperature during 1951-2015
* 1°C increase in max temp during 2041-2070 (RCP4.5)
* 1.5°C increase in max temp during 2071-2100 (RCP 4.5)

As a result, these impacts pose severe risks 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 create shorter rainy seasons and longer dry seasons making river basins more vulnerable. This District experiences climate hazards in the past such as floods, drought and heat waves.

* Flood
* Drought
* Heat waves

Flood

This region experiences heavy rain and flood during deep depressions/cyclones forms in the Bay of Bengal. In recent decades, some parts were affected during 2005, 2010, 2015 heavy rainfall events and Thane (2011) and Vardah (2016) cyclones. State Disaster Management Authority, Government of Tamil Nadu identified 75 locations of Thiruvannamalai District as flood vulnerability spots. 6 GPs are under moderate flood vulnerability in Arni Block.

Drought

Low rainfall coupled with the erratic behavior of the monsoon in the state makes Tamil Nadu the most vulnerable to drought. Thiruvannamalai District comes under drought vulnerable area as less than 40 % of normal rainfall was received and has experienced frequent droughts in the past, particularly in the years 2003 and 2009. The District also experienced severe drought during the year 2016- 2017. All parts of the District are affected by drought and its consequences are large area crop losses and drinking water scarcity. In Arni Block, all GP's are prone to drought.

Heat Wave

A heatwave is a period of abnormal high temperatures, more than the normal maximum temperature that occurs during the (hot weather) summer season. Heatwaves typically occur between March and June. The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death. Normally, all parts of this District witnesses heat waves. All GPs in Arni Block are prone to heatwaves.

2.2 WASCA CLIMATE VULNERABILITY INDICATORS

During 2019, WASCA TN conducted a preliminary State level scoping study on the State's rural water security through the climate lens and identified climate and water security hotspots/potential geographical areas for project demonstration through scientific criteria jointly with 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 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/m2)	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 bio-physical 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, Ramanathapuram and Tiruvannamalai 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 are envisaged for the above 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 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 technical partners of WASCA project Viz., MS Swaminathan Research Foundation (MSSRF), Prime Meridian and key sectoral experts. Based on 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 are 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
Changes in temperature, rainfall and its extremities	Watershed, micro-watershed, and drainage network, traditional waterbodies, 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	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

CONVERGENCE OF WASCA AND MAHATMA GANDHI NREGA

3 CONVERGENCE OF WASCA AND MAHATMA GANDHI NREGA

GIZ has evolved a GP based CWRM planning approach for facilitating convergent planning under MGNREGA for Water Security and Climate Adaption. This is as per the recommendations of National Level Workshop organized in February 2020, by MoRD, MoJS, GIZ, along with State Rural Development Department of WASCA. While developing the framework, inputs from all relevant stakeholders were considered including communities, public institutions, civil society, research organizations, and private agencies. The basis on which GIS based planning was developed for all GPs is the annual master circular issued during 2021-22 and the annual planning circular issued in September 2020 by MoRD.

The planning exercise for Mahatma Gandhi NREGS will be part of the convergent planning exercise for the Ministry. The thrust is on planning for works related to Natural Resource Management (NRM), Agriculture & Allied Activities and Livelihood related works on individual lands leading to sustainable livelihoods as well as provisioning of livestock shelters for individual households. The NRM related works under MGNREGS will be taken up in convergence with other programmes such as 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 at farm level. PMKSY aims to achieve a high degree of effective water availability and use for Indian farms, especially in water scarce regions. IWMP, Mission Water Conservation, Har Khetko Pani and Per Drop More Crop are the four pillars of PMKSY. Technical inputs for planning is to be drawn from the technical resources available in the District under MGNREGS, 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, and Water Resource Department and the Agriculture Department. The technical inputs relating to Excavation, Renovation & Modernization (ERM) of waterbodies may also be sought from the regional office of Central Ground Water Commission (CWC). The GPs will keep in perspective the Macro and Micro-watersheds of 500-100 ha that comprises of 1-10 GPs, while deliberating and finalizing prioritization of shelf of projects.

Special focus is given to vulnerable households and communities 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 will 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 playing a significant role in improving the livelihood conditions of the vulnerable people. 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.

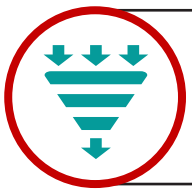
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

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 are related to NRM alone. Among NRM works, 85 activities focus on water conservation and harvesting while 164 works are related to Agriculture and Allied works. As MGNREGA activities benefit both the community and individuals, this should typically change 'relief works mode' to an integrated NRM perspective. Planned and systematic development of land and harnessing of rain-water 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 in the watersheds using web-GIS platform (Bhuvan Geoportal). The GIS (Geographical Information System) plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner. Section 22 of annual master circular provides the key steps for GIS based planning.



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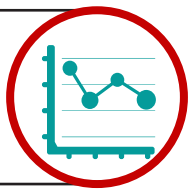
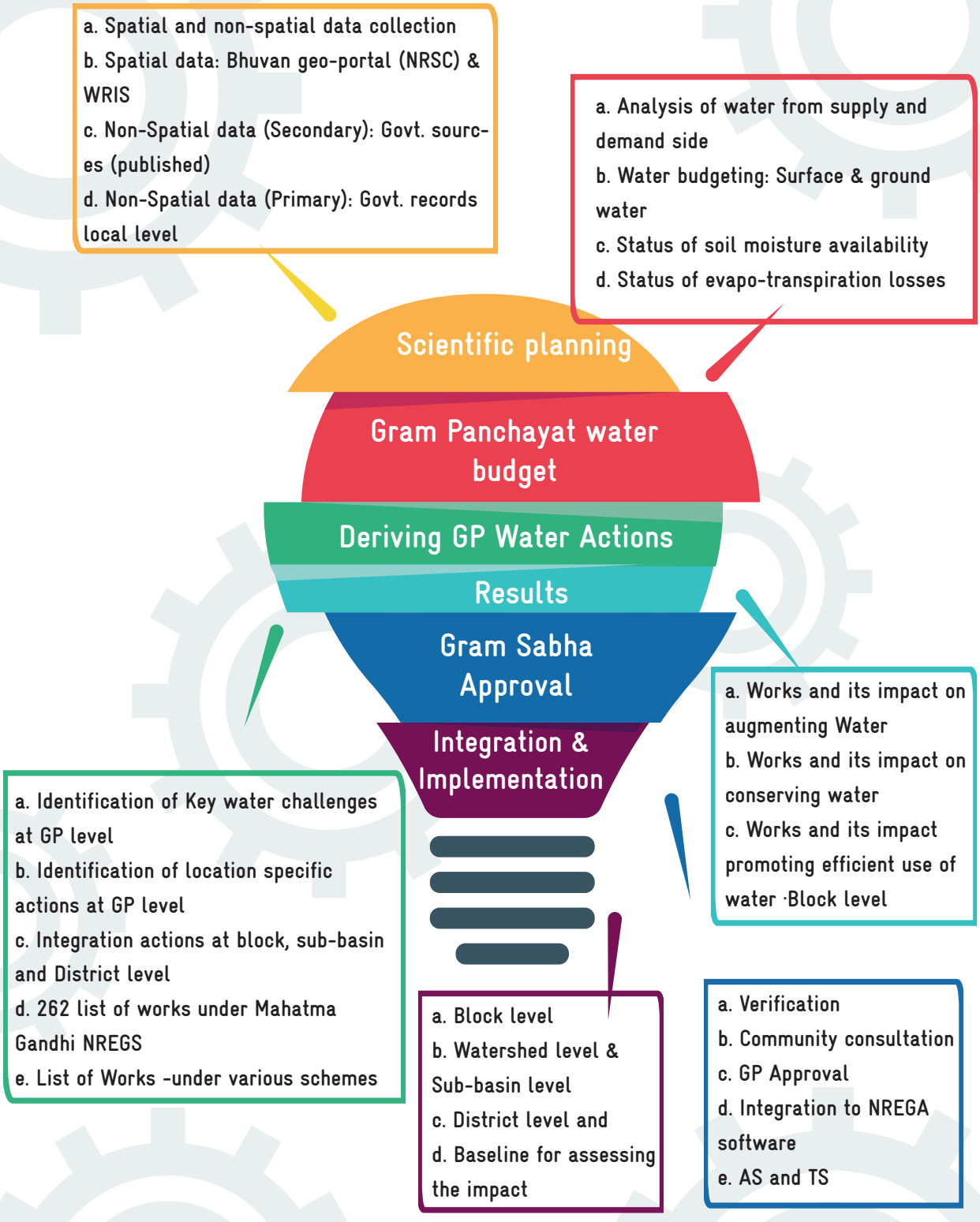


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

CWRM approach for WASCA uses simple scientific tools that can help Block or GP level officer to organize, analyze and prepare a developmental draft plan for participatory discussion at GP level. This approach involves analyzing key water challenges using both non-spatial and geo-spatial data in GIS, coupled with extensive ground truth verification. The non-spatial data includes the 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 GP as the lowest unit for 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-transpiration

and soil moisture are used to understand the climate related issues. The next step is to assess land use, watersheds, drainage networks and surface runoff, existing water supply and storage systems, water management for the key sectors and water demand and prepare the water budget for the GP (Box 1).

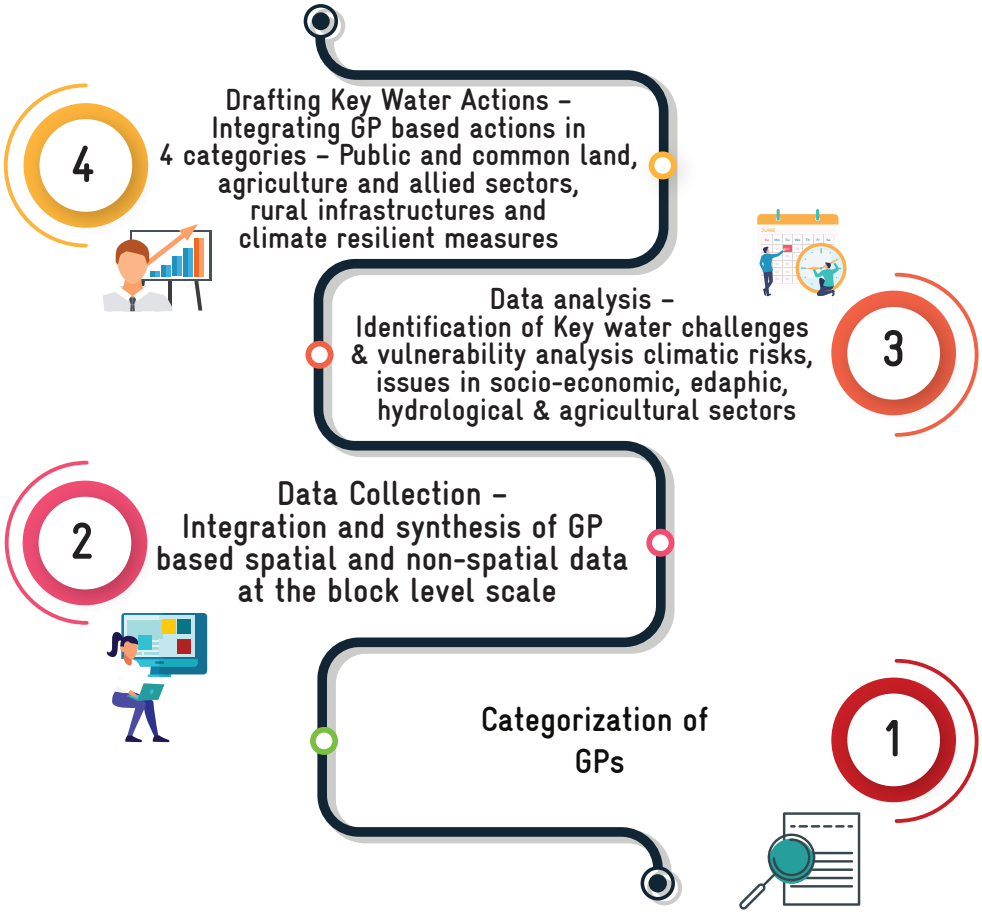
BOX 1. MAJOR COMPONENTS INVOLVED IN CWRM PLANNING



Such a comprehensive analysis helps in preparing the water budget integrating ground water, surface water through runoff from rainfall, evapo-transpiration and soil moisture which further helps to identify potential areas of action to augment the water resources in public /common land, agriculture and allied sectors and rural infrastructure dimensions. The analysis also helps to understand the areas of interest and appropriate climate resilient measure as an adaptive measure to the emerging climate change scenarios. The water challenge linked water actions are the key in developing the perspective plan for the water secured GPs, to serve as shelf of projects. This shelf of projects is again mapped with the schemes available 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), and convergence are some of the key aspects that needs attention for a tangible outcome in both NRM 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 into 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 by the National, State, and District Level Steering Committees headed by the Additional Chief Secretary RD&PR and the District Collector respectively in the project area of Tamil Nadu government as a comprehensive and climate adapted planning approach for water security under the Mahatma Gandhi NRGES 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

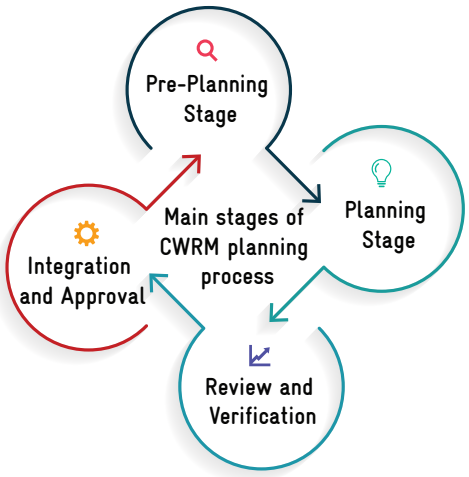
PLANNING STAGE

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 boundary for GIS planning, various GP's are categorized based on revenue village boundaries, for collecting and organizing the datasets. Based on the above factors, five different types of GPs are classified as Type I, II, III, IV and V. The description and basis on which GPs are categorized is given in Annexure 1. The details of Arni Block GP's categorization is tabulated in Table 4.

TABLE 4. CATEGORIZATION OF ARNI BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
12	GP and revenue village data and boundary match (Type-I)	Adaiyapulam, Adanur, Agarapalayam, Irumbedu, Morappanthangal, Meyyur, Puthur, Poosimalaikuppam, Randam Korattur, Vedugasathu, Vettiyantholuvan,Rattinamanagalam
22	Having more than one GPs in one Revenue Village (Type-II)	Chitheri, Velapadi, Kalleripattu, Mattathari, Ladavaram, Mamandur, Ladapadi, Katteri, Molugampoondi, Kalpoondi, Mullandram, Vedajipuram, Sathiyavijayanagaram,Nethapakkum, Kanigiluppai, Pudupattu, Vilai, Nesal, Sirumur, Srinivasa Udayavanam, Sangeethavadi
1	One GP is falling under more than Type 1 one Revenue Village (Type-III)	Paniyur
1	GPs having more than one GP, one Revenue Villages data, boundary (Type IV)	Ariyapadi

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 Land Use and Land Cover (LULC), waste land, salt and erosion affected lands, drainage lines, ground water potential, lineament, geomorphology, and slope will play a significant contribution in the preparation of the most appropriate and suitable science-based decision plan 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

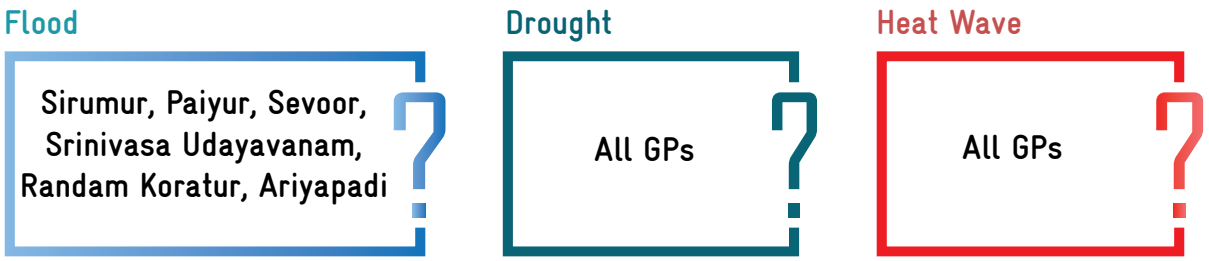
- Water budgeting at GP level to demonstrate the sector wise water demand and available water through the traditional water harvesting and storage bodies and the potential runoff that can be conserved through appropriate actions on the supply side. The difference between demand and supply at the GP level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

Data from a total of 99 parameters were collected, out of which 13 parameters are primary source data and were collected at GP administrative units by GPs officers. 65 parameters are secondary source data 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.

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 and currently, data at Block level is not available. Hence, previous hydro-meteorological disasters are considered to denote Block's change in climate (temperature, rainfall) extremities and its risks, which was recorded by State Disaster Management Agency, 2020 (Table 5).

TABLE 5. CLIMATE RISKS AND VULNERABLE GP'S



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 are 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 domestic, agriculture and livestock are collected from authorized open sources and analyzed at Block level are as follow

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 on 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 has further expended with landform maps, were widely used in various fields of hydrology, pedology, geoscience, urban and regional planning etc. Arni Block is majorly engrossed with denudation origin pediment and pediplain complex and minute areas in northern region witnessed structural origin land form (Figure 3.1). Pediment is the low relied or plain with gentle slope area close to the foot of the mountains with or without debris whereas pediplain is relatively flat rock surface formed by joining of several pediments. Fundamental information of landform by its units will act as critical input in the identification of suitable sites for NRM activities under CWRM plan preparation.

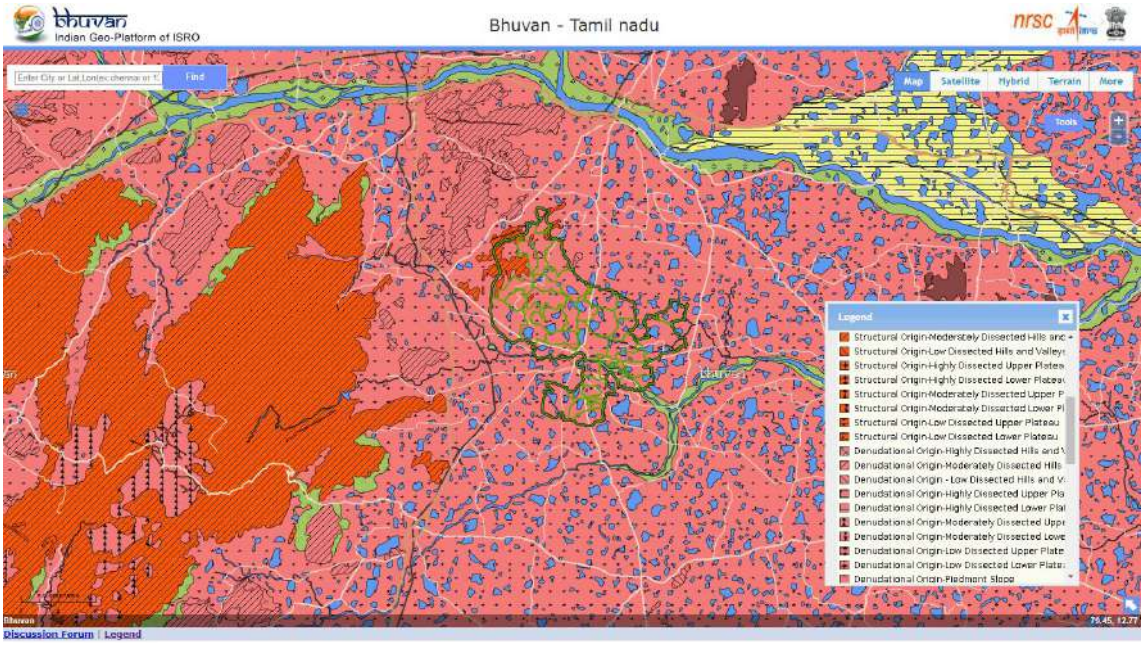


Figure 3.1. Geomorphology map

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

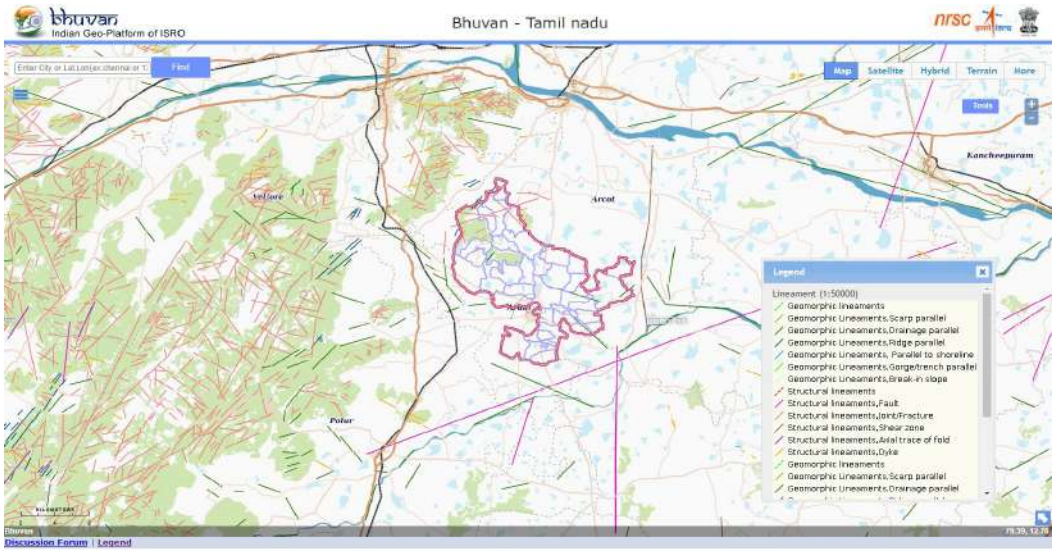


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Geomorphic lineaments, Drainage parallels	
	Irumbedu, Kalpoondi, Kanikilippai, Katteri Muzhugampoondi, Panaiyur
Structural lineaments, Joint/ Fracture	
	Puthur, Mullandram, Poosimalaikuppam

3.5.1.3 Terrain: The terrain map is a product of Digital Elevation Model (DEM), which gives information related to elevation from above sea level used to represent the relief features. It is noticed that the Block fall within two ranges of elevation, North-Eastern region of higher elevationa (green color) and rest is lower elevation range (grey color, Figure 3.3). This map will be useful in identification of better suitable sites for proposing the water and soil conservation related activities.

Figure 3.3. Terrain map

3.5.1.4 Contour map: The contour is the most important element in the cartographic representation of the terrain and only one which determines relief forms such as valleys and hills, and the steepness or gentleness of slopes geometrically. A contour map is illustrated with contour lines which shows the elevation of that earth surface from above sea level. The constant vertical distance between two consecutive contours, i.e. their height difference, is called contour interval. Density of the contour lines are related to the geomorphologic units, mountain/ hilly areas were witnessed the high density then plain area in the Arni Block. The contour map also plays a vital role in delineation of watershed & its units, used in planning and identifying the recharge structures, farm ponds and construction of grey water drain network etc., (Figure 3.4).

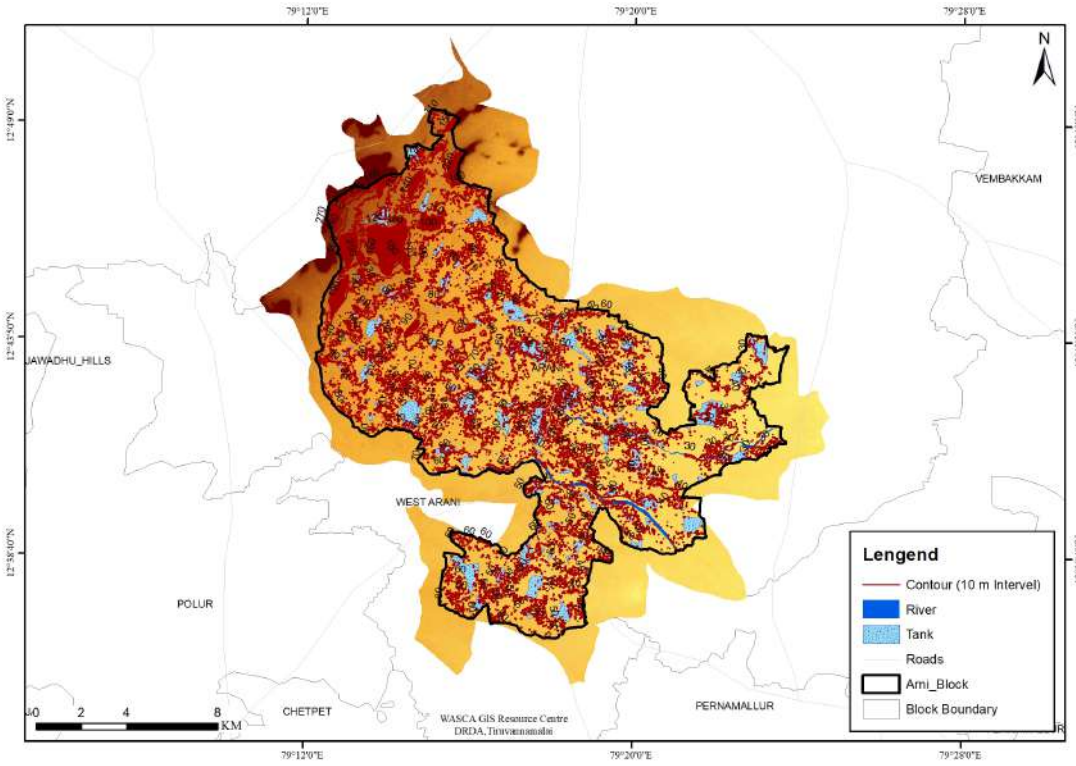


Figure 3.4. Contour map

3.5.1.5 Slope: The average slope of a terrain feature is calculated from contour lines on a topo map or DEM. Slope is typically expressed in percentage or angle, or in ratio. Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. It is noticed that respect to the land-form units the slope get varies in the Block (Figure 3.5). Very flat, flat and steep slope ranges were noticed in the Block, GPs which are situated in North –East region withnessed the steep slope, as move towards flat to very flat sureface can notice. GP wise detailed is shown in the below illustration. Slope information plays a significant role in identification of soil eroded sites, depth profiles, also used in analyzing / proposing the soil conservation measures such as check dam, farm ponds etc.

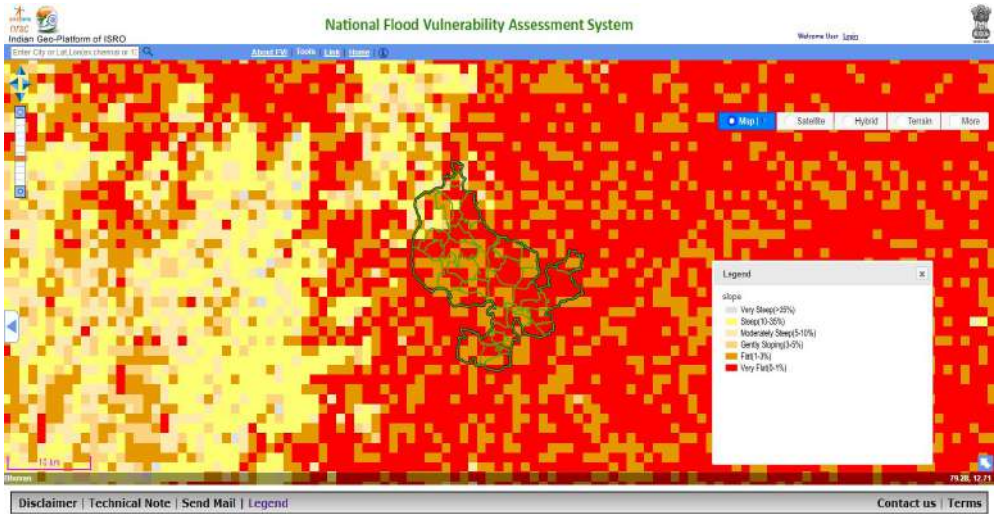
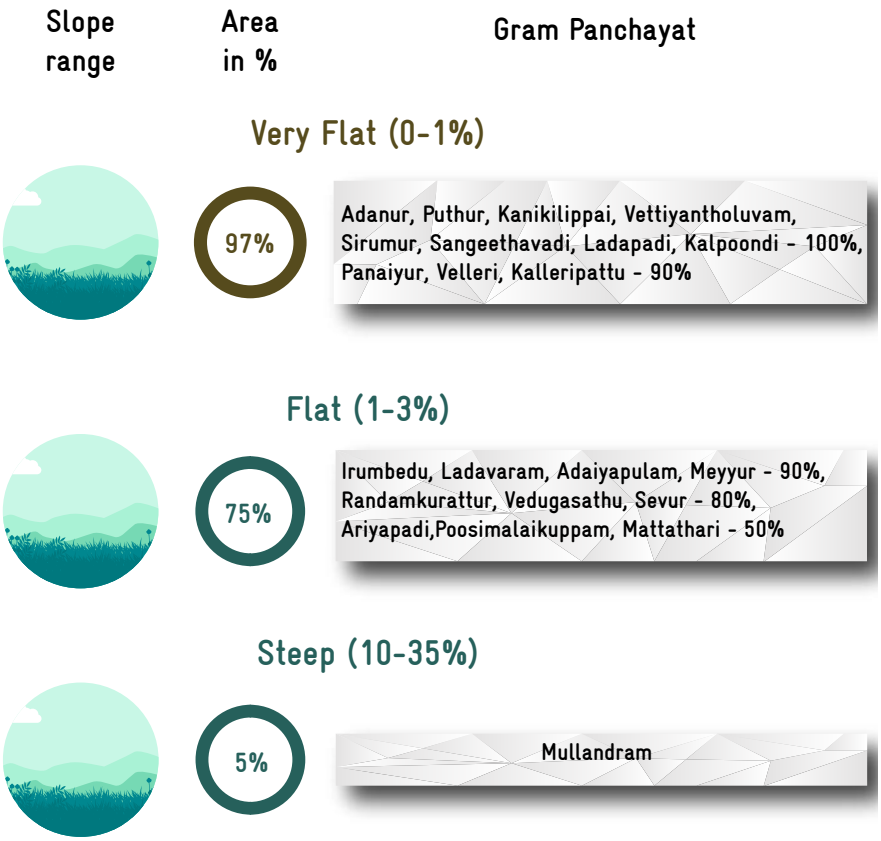


Figure 3.5. Slope map



3.5.1.6 Drainage Network : Drainage network pattern of a region is particularly dependent on the litho-logical characteristics, regional slope, structural control, climate condition etc. Dendritic or tree pattern drainage system was observed in Arni Block. Block area is drained with moderately less dense drainage network (Figure 3.6). The dendritic pattern is characterized by irregular branching of tributary streams in all directions. Drainage network is referred in identifying the suitable sites for soil and water conservation measurements such as dams, ponds, bunding, restoration of gullied region etc.

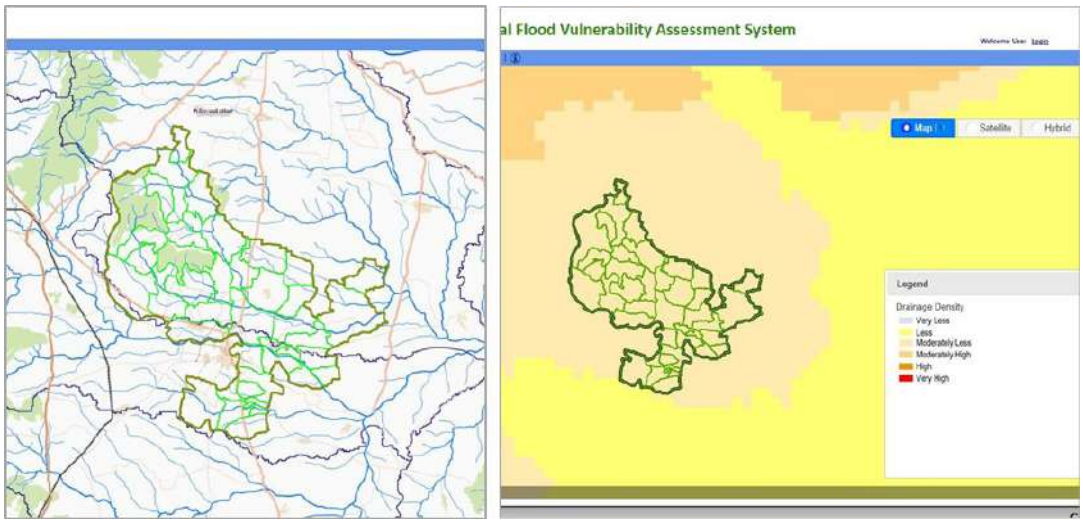


Figure 3.6. Drainage network and density map

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. Arni 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.

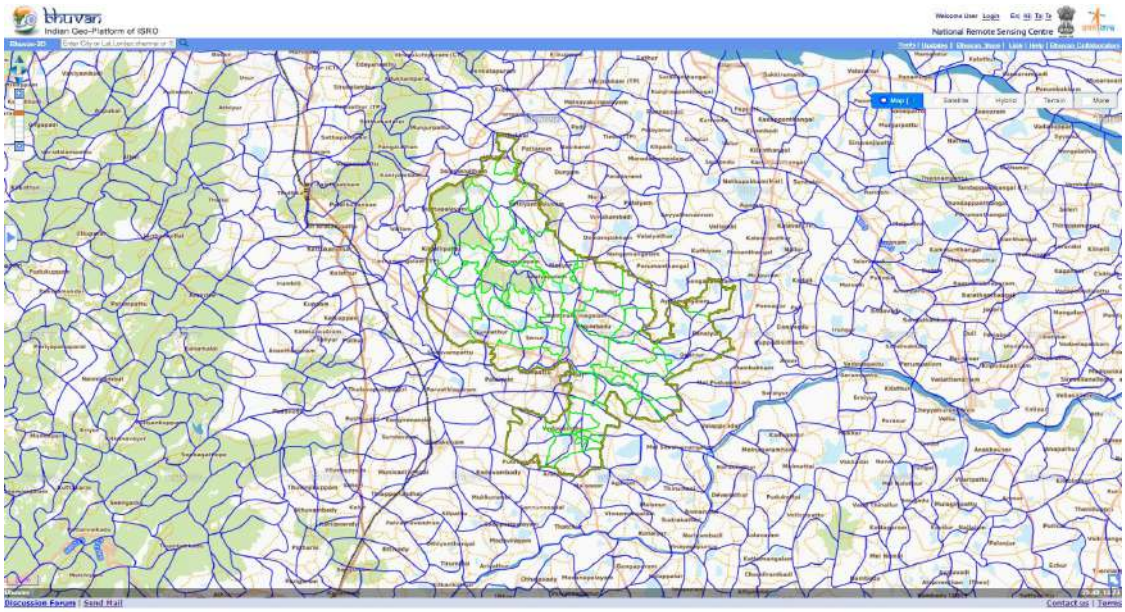


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water (GW) is one of the important natural resource in semi-arid region like Arni 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. Most of GPs area is witnessed the enrich yield of 50-100 LPM in above 80 m deep well, whereas Mullandram GP with no yield (Figure 3.8). The GPs wise detailed of GW prosperity shown in below illustration. This specific information is will play crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

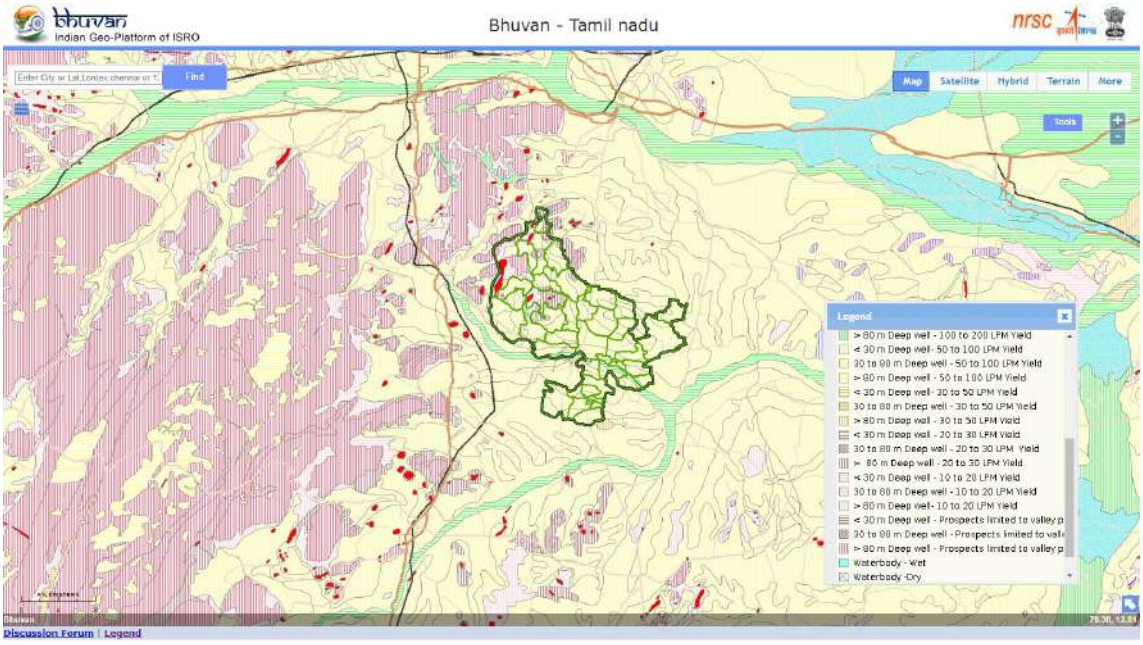


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat
› 80 m Deep Well- › 20 to 30 LPM Yield	20%	Vedajipuram - 50%, Morrappanthangal, Mullandram - 5%
› 80 m Deep Well- 50 to 100 LPM Yield	100%	All GPs except rfs
No Yield	10%	Mullandram

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). Detailed GP wise current water resources state and its supply and demand side are shown in Annexure 3.6.

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

Sl. No.	Canal Network	Extent
	Canal Network	
1	Length of Main Canal (m)	99,340
2	Length of Minor Canal (m)	27,880
3	Length of Distributaries (m)	450
4	Water Courses (Field Channels) (m)	54,030
	Traditional Waterbodies	
5	Number of Tanks (PWD & Union) (No.)	96
6	Number of Ooranis (No.)	3
7	Other Surface Waterbodies (No.)	103
	Area under Irrigation Facilities (ha)	
8	Tank Irrigation	285.9
9	Open & Tube Well Irrigation	5,787.39
	Catchment Area wise Available Runoff (ha.m)	
10	Good Catchment Area	6,001.11
11	Average Catchment Area	295.70
12	Bad Catchment Area	3,222.35
	Watershed and Drainage Networks	
13	Length of Natural Drainage Lines (m)	1,16,289
14	Number of Natural Drainage Lines (No.)	140
15	Number of micro-watersheds (No.)	173
	Water Demand	
16	Water Demand For Humans (ha.m)	298.82
17	Water Demand for Livestock (ha.m)	170.09
18	Water Demand For Agriculture (ha.m)	11,423.82
19	% G.W Utilization for Drinking	15
20	% G.W Utilization for Livestock	88
21	% G.W Utilzation for Agriculture.	97
22	% SW Utilization for Drinking	85
23	% SW Utilization for Livestock	12
24	% SW Utilization for Agriculture	3

3.5.2.1 Existing Water Structures

The Block has structured traditional water storage units as tanks, ponds and Ooranis which are the life line for their lives and livelihoods. The Block has 96 tanks, 3 Ooranis and 103 other surface waterbodies (Figure 3.9).

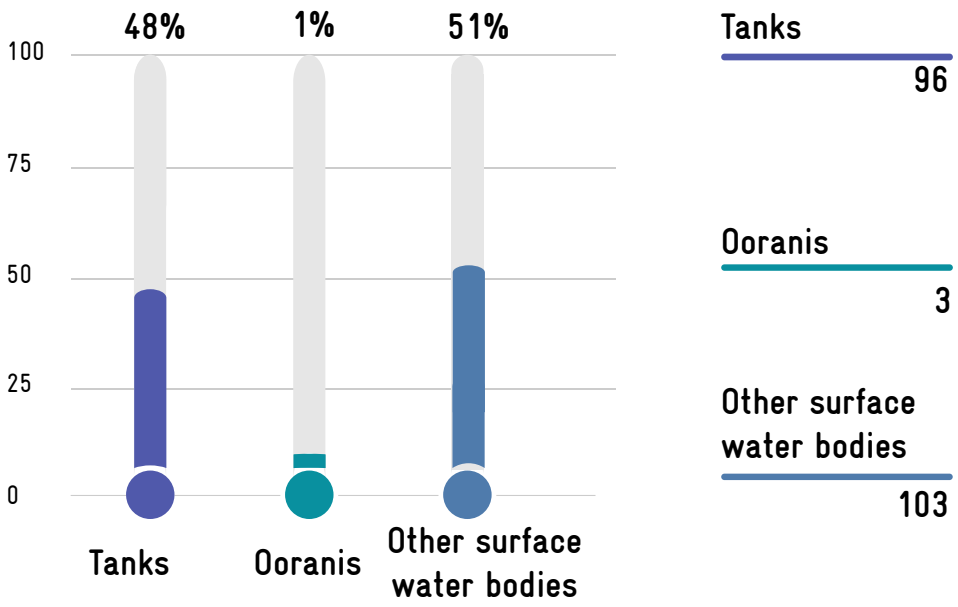


Figure 3.9. Number of traditional waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 6,073.29 ha, of which 95.32 % (5,787 ha) is irrigated through open & tube well remaining is from tank based irrigation (Figure 3.10).

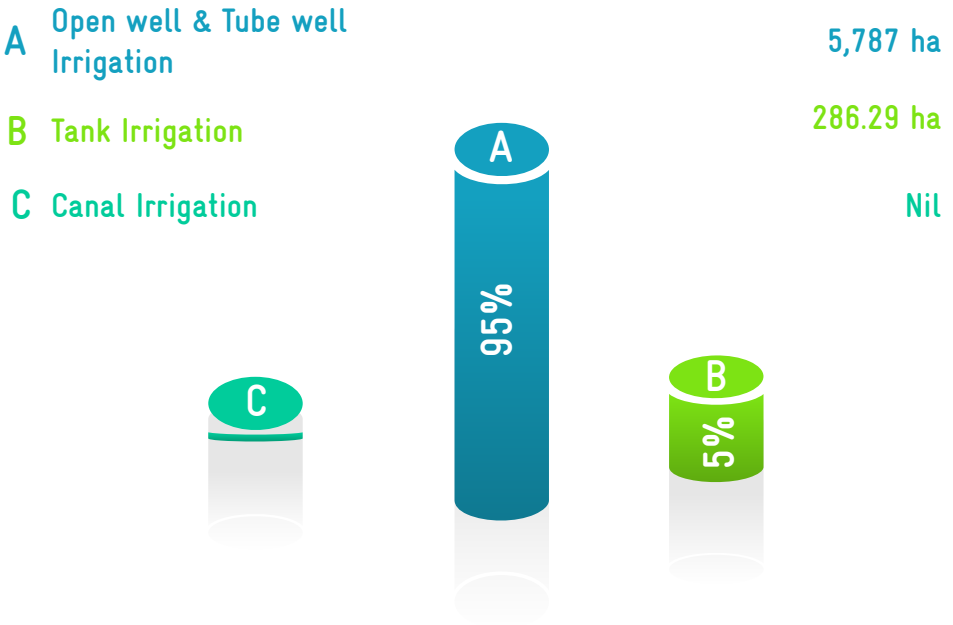


Figure 3.10. Irrigation Sources

3.5.2.3 Available Run off

The available runoff in catchment area is 9,519.19 ha.m of which 63 % (6,000.11 ha.m) comes under good catchment area, 3 % (295.70 ha.m) comes under average catchment area and 33.85 % (3,222.35 ha.m) comes under bad catchment area (Figure 3.11).

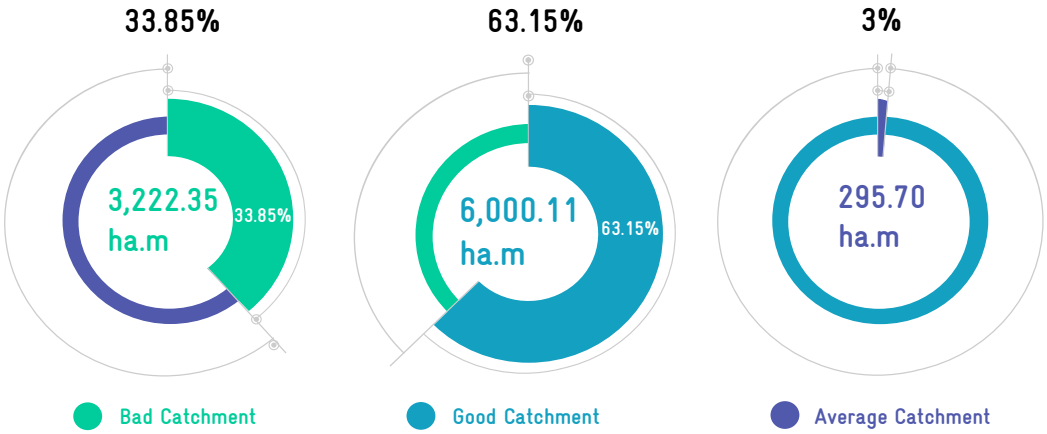
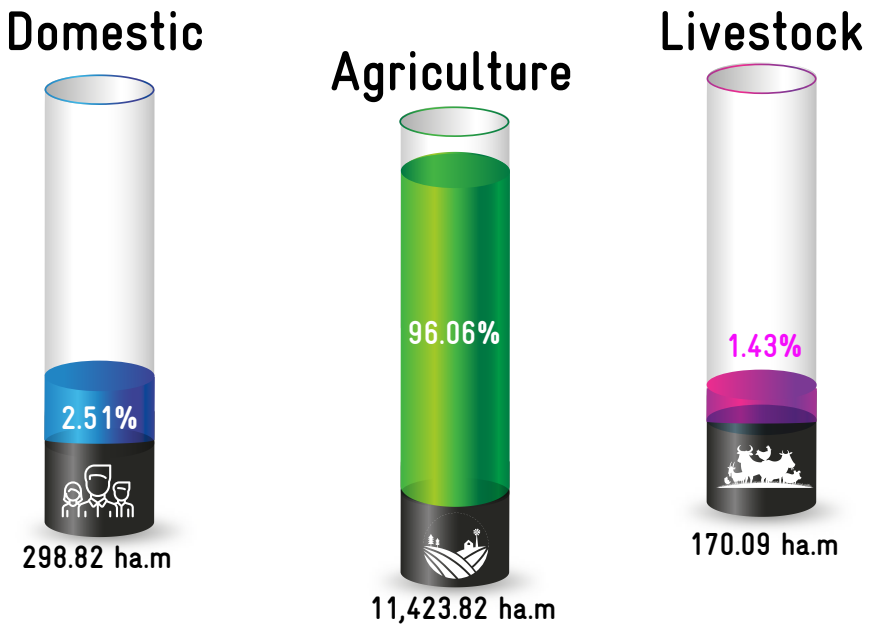


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 11,892.73 ha.m. In which 298.82 ha.m for domestic, 170.09 ha.m for livestock and 11,423.82 ha.m for agriculture sector. The utilization of ground water is more than surface water for agriculture and livestocks. About 97 % of the agriculture purpose is met through groundwater and 88 % for livestocks. At the same time, utilization of surface water is more for domestic purposes (78 %) (Figure 3.12).



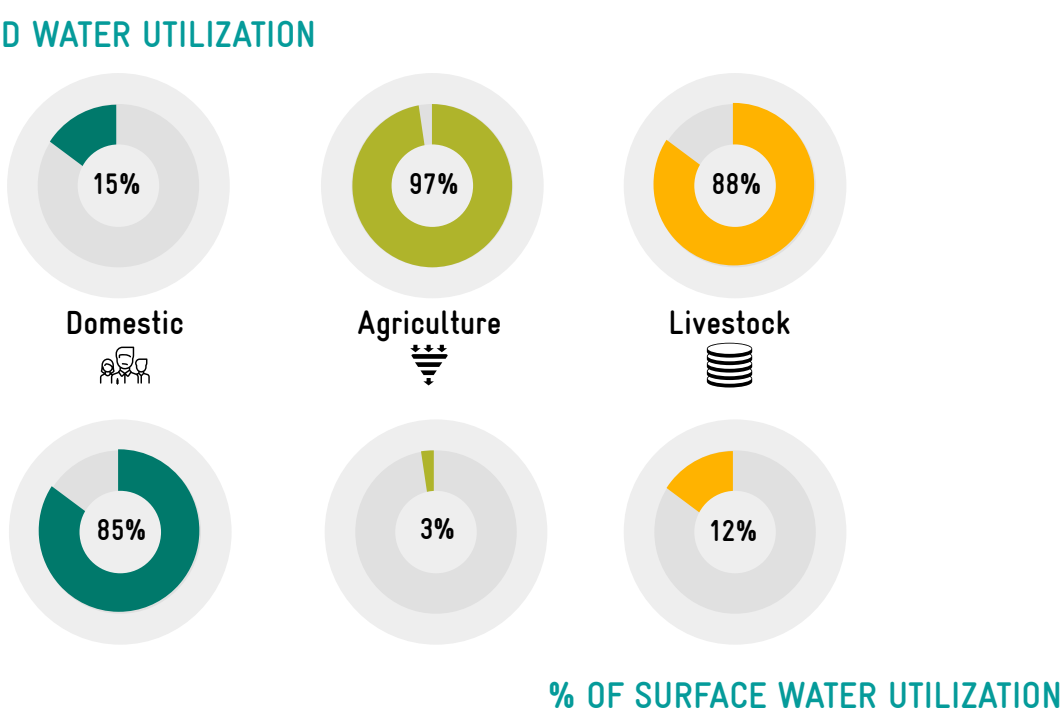


Figure 3.12. Sector wise water utilization

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

Agriculture is the primary livelihood of the households in Arni 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 to LULC, waste land, salt affected land, soil erosion and soil texture was referred to understand the Arni problems in order to draft scientific key water actions.

3.6.1.1 Soil texture: The District has diverse soil types and predominant in vertisol and alfisol, with reference to soil texture the proportion of fine texture type is dominated followed by clay skeletal and coarse loamy (Figure 3.13).

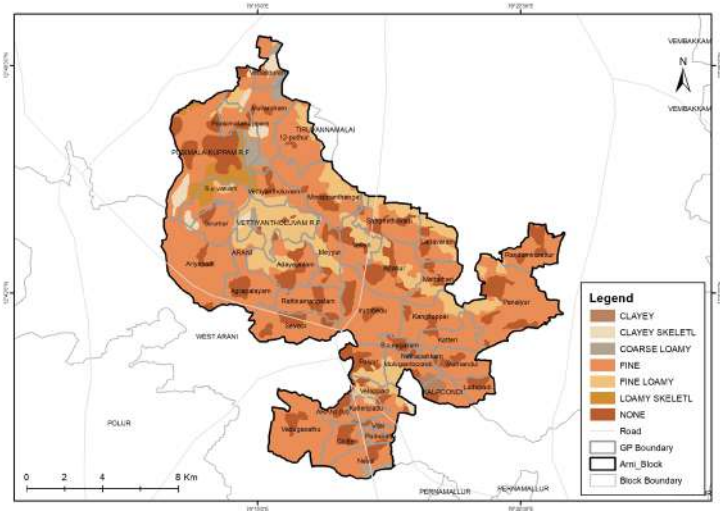


Figure 3.13. Soil texture map

3.6.1.2 Soil erosion: Soil erosion is a natural process of displacement of upper layer of soil caused by dynamic erosion agents that is, water, air, plants and humans. Soil sheet erosion was witnessed in 5 % area of Vedugasathu, Adaiyapulam, Suvanam, Ariyapadi, Sangeethavadi, Panaiyur and Ladavaram GPs. (Figure 3.14). The soil eroded units will act as a direct input while preparing plans for soil conservation and watershed management activities.

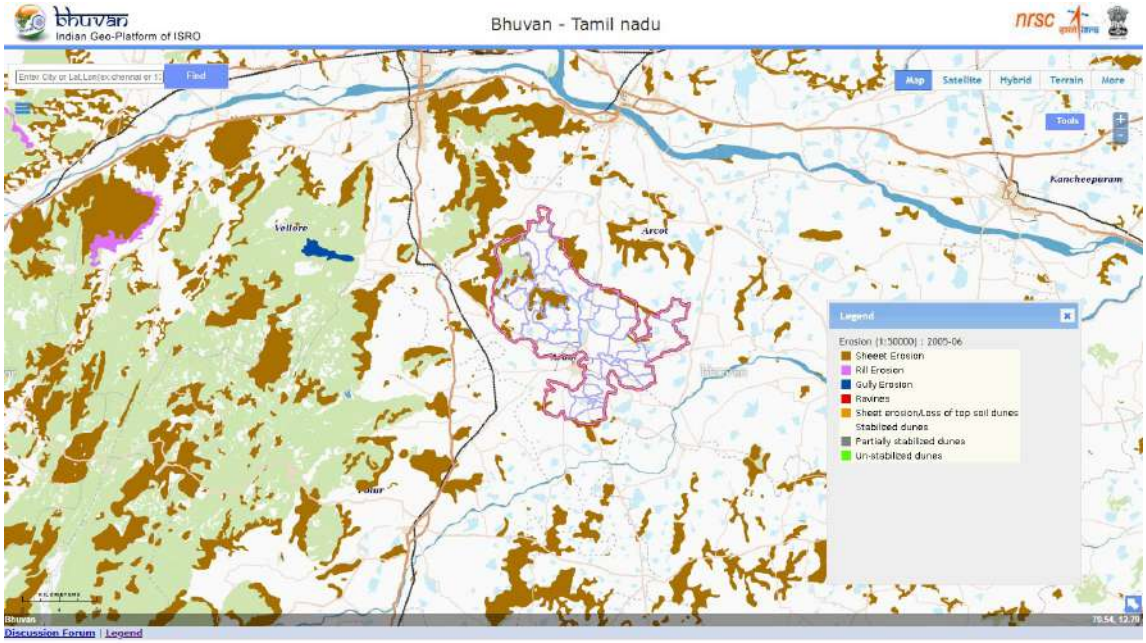
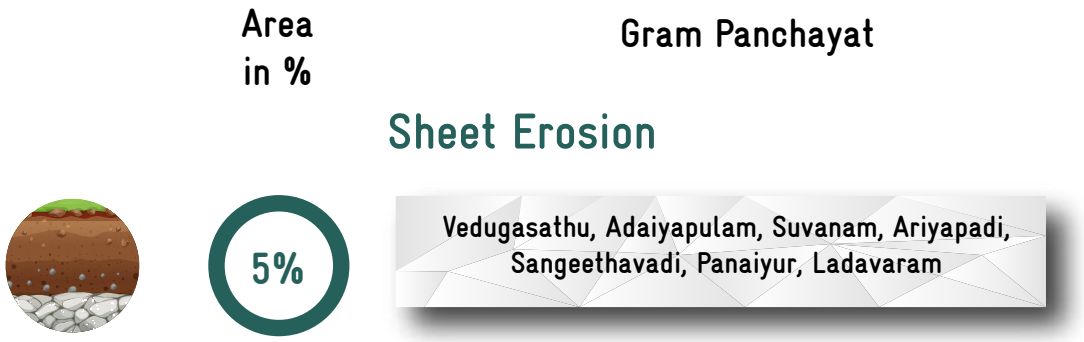


Figure 3.14. Soil erosion map



3.6.1.3 Land Use & Land Cover (LULC): LULC is 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 have become increasingly important as which, in turn, underlie many environment-development policies. A major area of Arni Block is agricultural land and barren lands (Figure 3.15). LULC map helps the decision makers and planners in focusing on the fallow land development activities. During the CWRM planning of GPs, activities for fallow lands have been proposed based on the data.

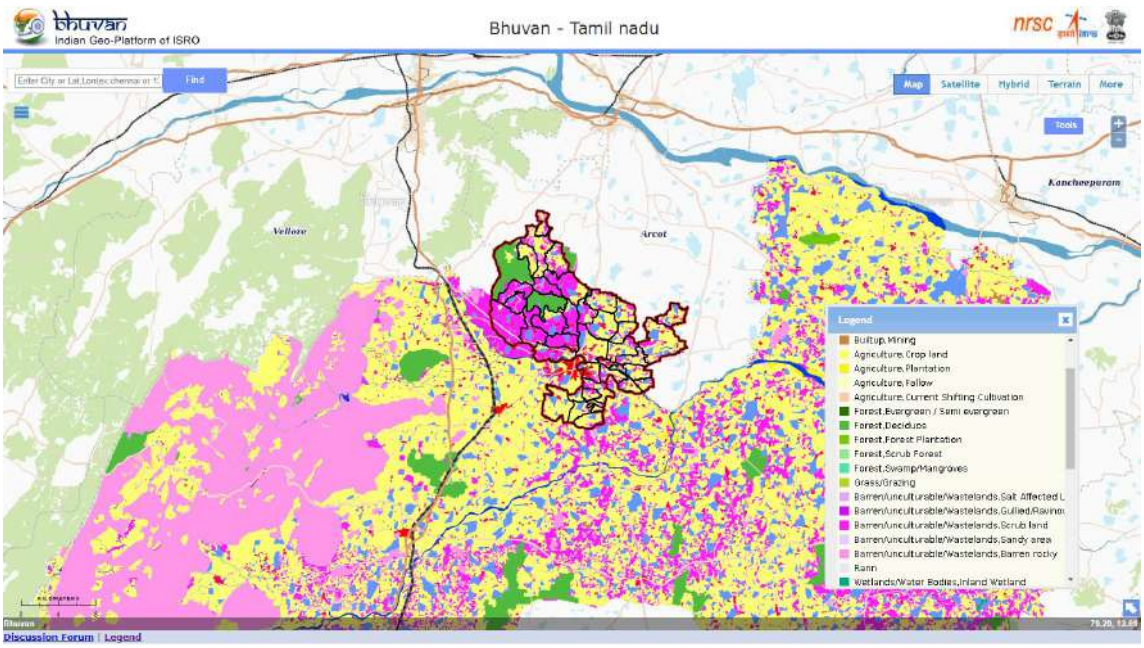


Figure 3.15. Land use land cover map

Land Use	Area coverage in %	Gram Panchayat
Barren Lands	96%	Ariyapadi, Sirumur, Su vanam, Vettiyantholuvam, Agarapalayam, Rattinamanagalam - 100%, Morrappanthangal, Adaiyapulam, Meyyur, Sevur - 90%
Agriculture crop lands and Plantation	92%	Vedugasathu, Mullandram, Nesal - 100%, Chitteri, Irumbedu, Adanur, Sangeethavadi, Katteri, Panaiyur, Poosimalaikuppam - 90%, Mamandur - 80%

3.6.1.4 Waste land: A parcel of land which is not suitable for any agricultural activity and mostly covered with dense or open scrub is called as wasteland. Data on wastelands acts as a direct input in the preparation of plans for land development activities or greenery. Wasteland parcels scrub land are noticed in some pockets of the Block (Figure 3.16). The scrub land is observed in the GPs Panaiyur, Kanikilippai, Mullandram, Mattathari and Adanur GPs. The area of the GPs with scurb lands area shown below.

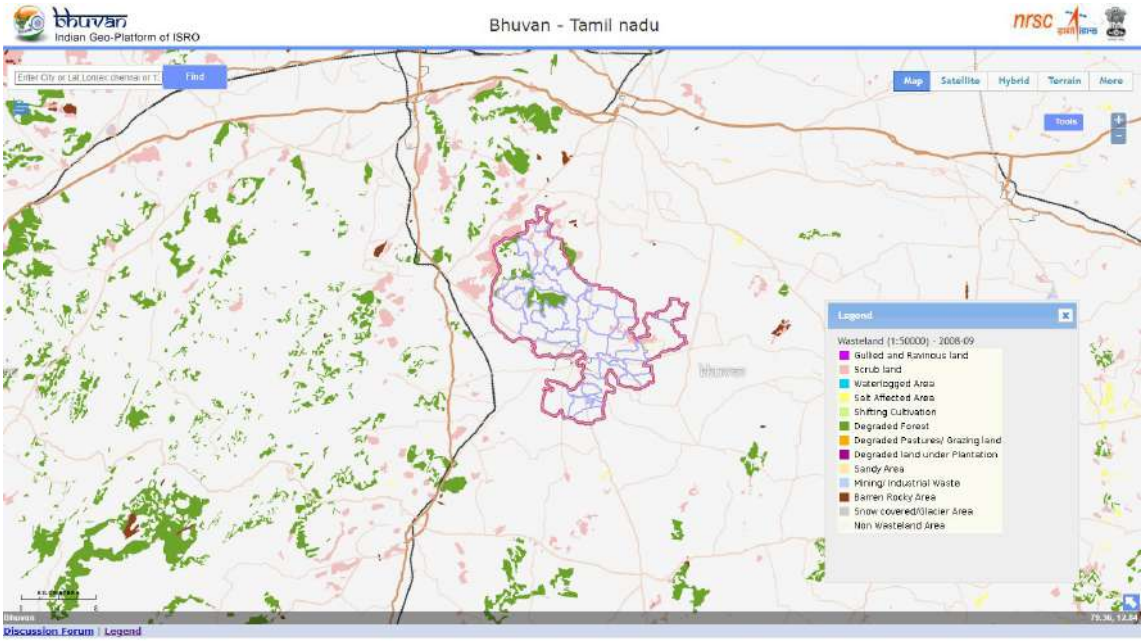
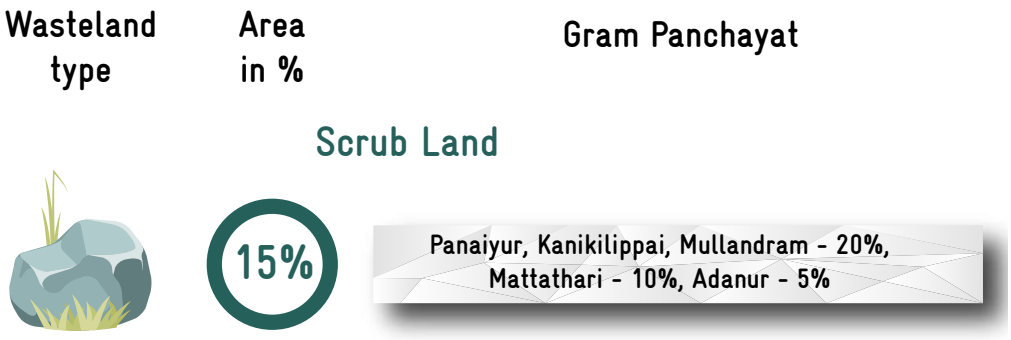


Figure 3.16. Wasteland map



3.6.1.5 Salt affected area: Moderate salt affected areas is noticed in Panaiyur, and Katteri GPs (Figure 3.17). This data helps in making plans on soil conservation measures, mainly reducing salinization activities and suggest alternative cropping.

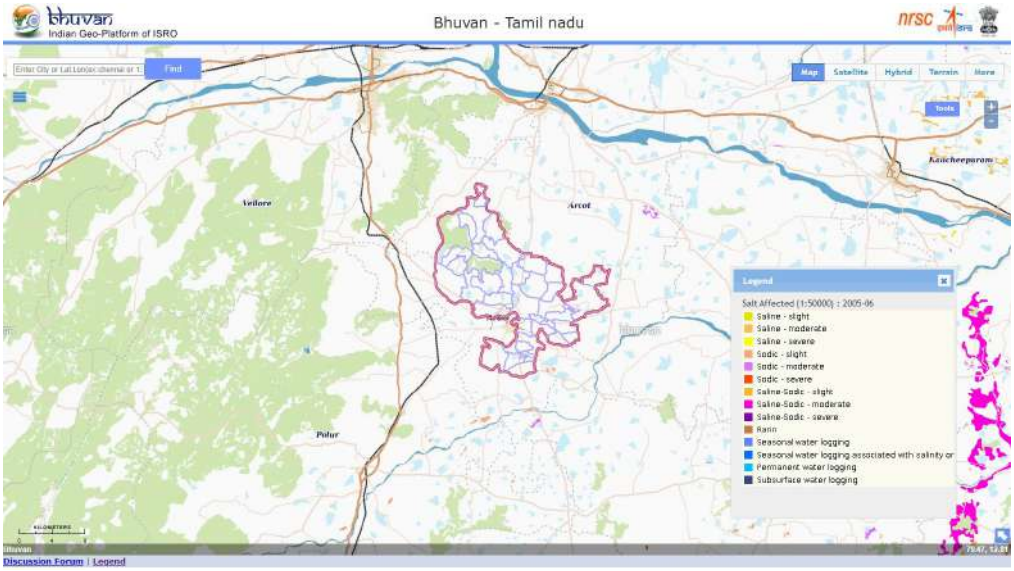
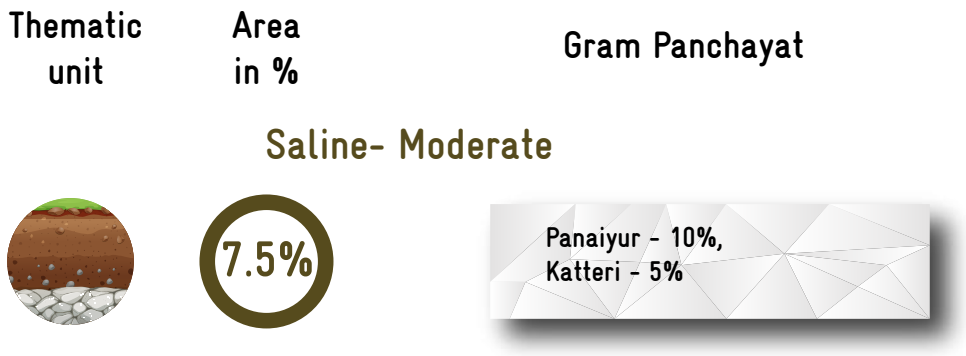


Figure 3.17. Salt affected area map



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 3.7.

TABLE 7. CWRM PARAMETERS BASED AGRICULTURE AND ALLIED ACTIVITIES RESOURCES IN THE BLOCK

Sl. No.	Key parameter	Extent
	Area under Land Resources (ha.)	
1	Non-Agricultural Uses	5,596.47
2	Barren & Un-cultivable Land	10,376.32
3	Permanent Pastures and Other Grazing Land	51.29
4	Land Under Miscellaneous Tree Crops etc.	2.81
5	Cultivable Waste Land	612.35
6	Fallows Land other than Current Fallows	1,409.23
7	Current Fallow land	6,704.80
8	Unirrigated Land	2,376.11
9	Area Irrigated by Source	6,742.65
	Catchment Area (ha.)	
10	Good Catchment	15,972.79
11	Average Catchment	666.45
12	Bad Catchment	17,232.78
	Crop Details	
13	Irrigated Area (ha.)	8,324.36
14	Rainfed area (ha.)	924.26
15	Area under Paddy Cultivation (ha.)	6,438.06
16	Crop Water Requirement - Irrigated condition (ha.m)	11,040.72
17	Crop Water Requirement - Rainfed condition (ha.m)	383.12
	Soil Resources: Status of Available Nitrogen (%)	
18	Very Low	26
19	Low	63
20	Medium	11
	Status of Organic Carbon (%)	
21	Very Low	29

22	Low	59
23	Medium	11
	Status of Soil Micro Nutrients (%)	
24	Sufficient	50
25	Deficient	50
	Status of Physical condition of the soil (%)	
26	Moderately Acidic	1
27	Slightly Acidic	6
28	Neutral	4
29	Moderately Alkaline	89
	Soil Texture (%)	
30	Clay Soil	3
31	Fine Soil	81
32	Coarse loamy	4
33	Soil Water Permeability	Moderate
	Soil moisture and ET	
34	Volumetric Soil Moisture (%)	23
35	Estimated Soil Moisture (ha.m)	20,763.7
36	ET Losses (ha.m)	5,403
	Means of Water Extraction (%)	
37	Gravity	5
38	Lifting	95
	Irrigation Methods (%)	
39	Wild Flooding	12
40	Control Flooding	88
	Livestock (No.)	
41	Cattle Population	45,517
42	Sheep Population	24,464
43	Goat Population	13,533

3.6.2.1 Land Use

The standard land use classification helps to understand the distribution and 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 33,872 ha, 30.63 % of land is barren & un-cultivable, followed by 19.91 % area Irrigated by source and 19.79% is current fallow land. Less than 1% area is pastures or grazing land and land under miscellaneous tree crop lands. (Figure 3.18).

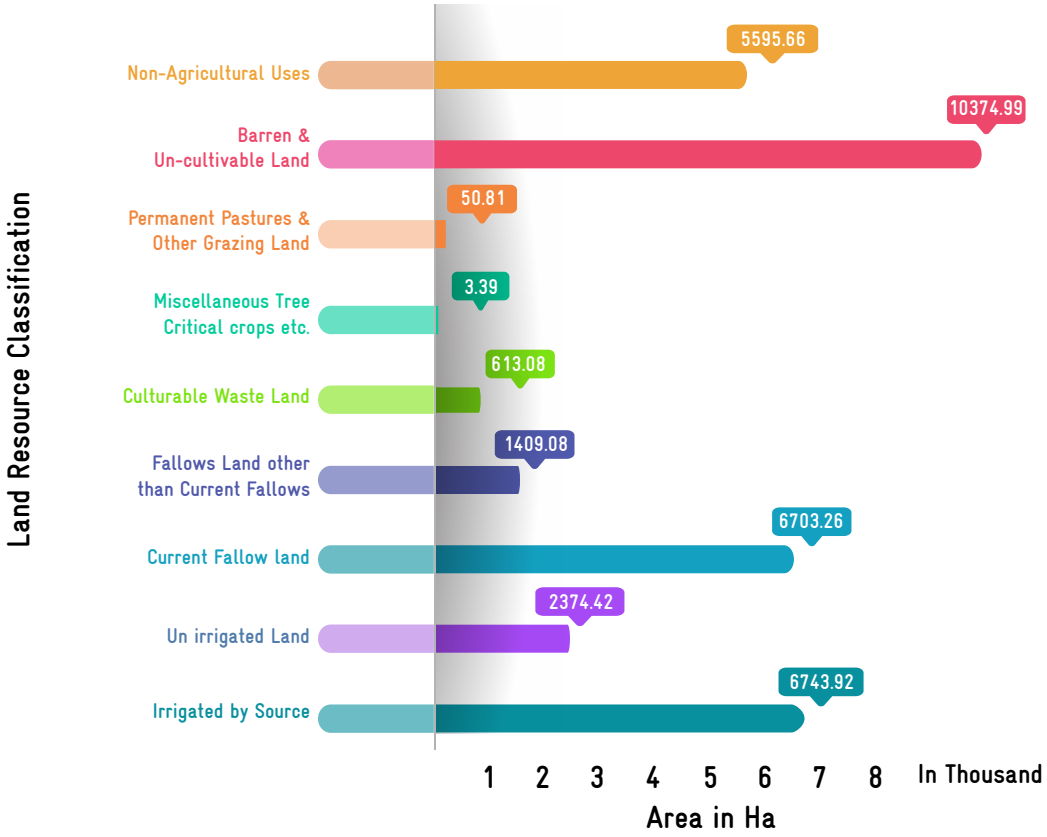


Figure 3.18. Land resources

3.6.2.2 Catchment Area

The land use types in each of the GPs are categorized into three different types of runoff: Good, Average and Bad Catchment area. Out of total catchment area (33,872 ha), the highest of 50.88 % area is from bad catchment area followed by 47.16 % from good catchment area and rest is from average catchment area (Figure 3.19). The runfoff generated through bad catchment slightly higher than the good catchment. This information helps to prioritize and propose treatment activities.

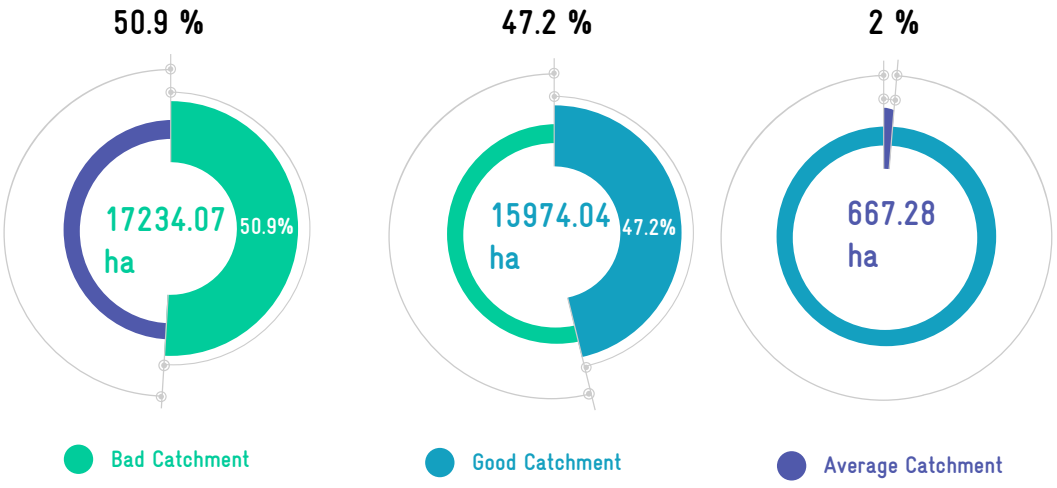


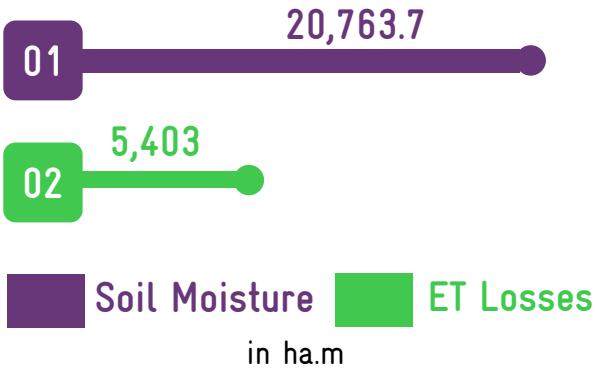
Figure 3.19. Catchment area

3.6.2.3 Soil moisture

Soil is an important medium to store the available water and the storage capacity varies with the type of soil especially its textural composition. In overall composite water budgeting, estimation of stored water in the soil assumes greater significance in this Block because of its significant proportion of area under rain-fed cultivation. The annual average volumetric soil moisture of this Block (23%), is taken for estimating the amount of water stored as soil moisture which accounts to 20,763.7 ha.m.

3.6.2.4 ET losses

The loss of water through ET is important in water budgeting. The annual total ET loss during 2018-19 was 804 mm with monthly average of 67.08 mm. The average percentage of water loss through ET in the Block is 23% and the total annual losses due to ET alone is 5,403 ha.m.



3.6.2.5 Macro soil nutrients
Nitrogen Status

The macro soil nutrients such as nitrogen and organic carbon falls under very low to medium category in the total number of soil samples tested. The available nitrogen is very low in 26 % of the samples tested while it was 63 % under low category and 11 % of medium (Figure 3.20). According to soil resource map, this Block is identified as one of the nitrogen deficient Block (Tiruvannamalai District profile 2020).

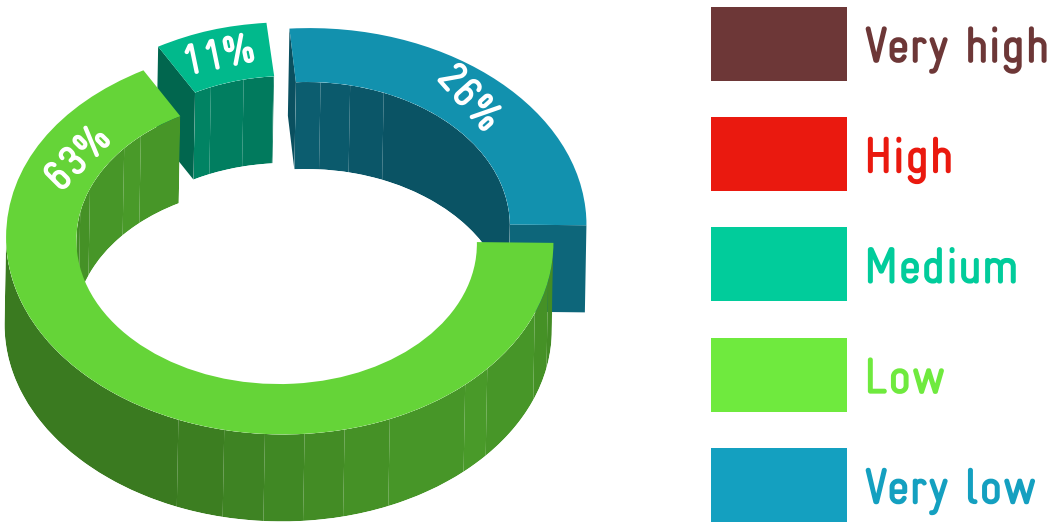


Figure 3.20. Status of available Nitrogen

Organic Carbon Status

A similar trend has been recorded for soil organic carbon. Soil organic carbon is varied from very low to medium category in this Block. The highest of samples witnessed the low of 59 % followed by 29 % of very low and rest are medium category (Figure 3.21). This indicates that the soil fertility is very poor and further intensive practices make soil more vulnerable to degradation over a period of time.

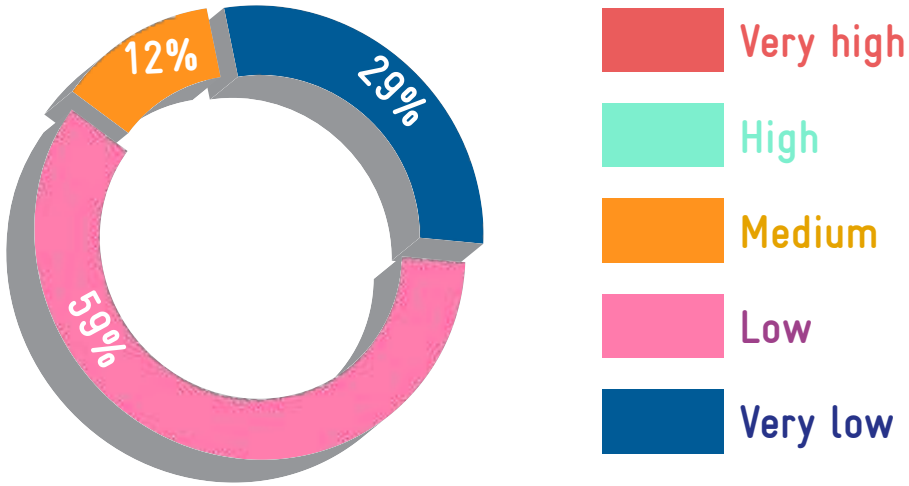


Figure 3.21. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro-nutrients

This Block is one of the zinc deficient Block of Tiruvannamalai District. Of the soils tested, the micro nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 50 % samples and 50 % sufficient (Figure 3.22)

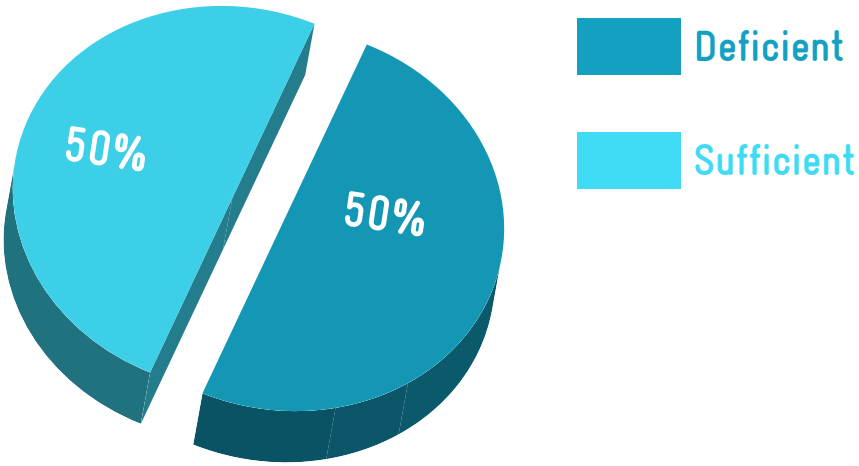


Figure 3.22. Status of soil micro nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 89 % of the soils are moderately alkaline in nature, six percent is slightly acidic, four percent is neutral, and one percent is moderately acidic in nature (Figure 3.23).

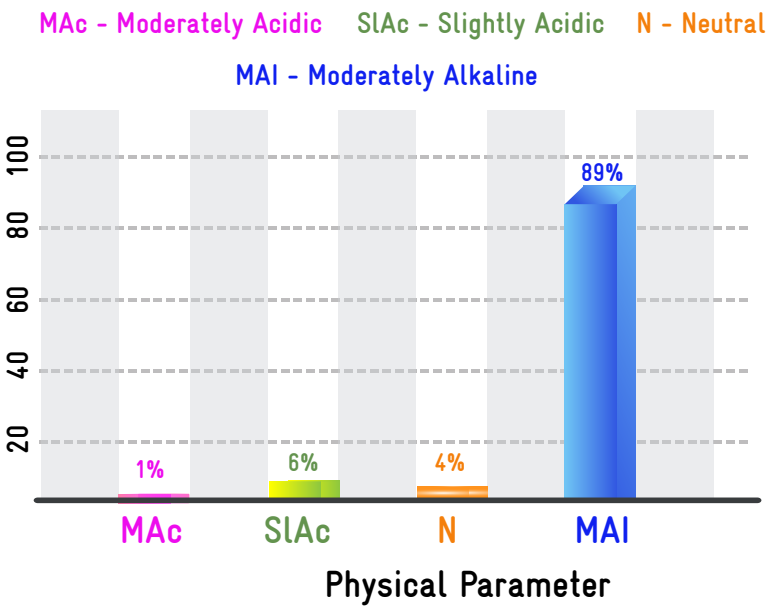


Figure 3.23. Status of pH of soil

3.6.2.8 Cropping pattern and the irrigation

The total of 10,178.7 ha of land is used for crop cultivation, of which 92.14 % area is under irrigation praticies and remaining 7.6 % is under rain-fed cultivation. Paddy is the predominantly crop in irrigation area, accounts to about 47.44 % to total irrigation area followed by ground nut of 38 % while other pulsus are dominated in redfed area (Figure 3.24). Also, domestic crops such as pulsus, vegetables, fruits etc grows and accounts less than a percent to total crop land area.

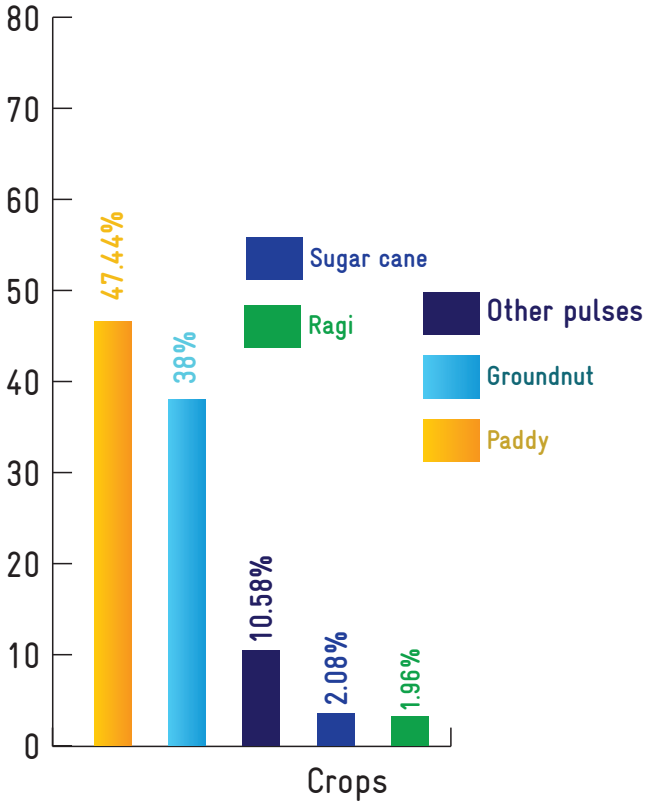


Figure 3.24. Cropping pattern

3.6.2.9 Irrigation methods

In case of surface water resources, wild flooding is the primary method of irrigation. But in case of ground water resources, the predominant type of irrigation is controlled flooding. In the Block, 87 % of the irrigation is done by control flooding and rest is of wild flooding irrigation (Figure 3.25).

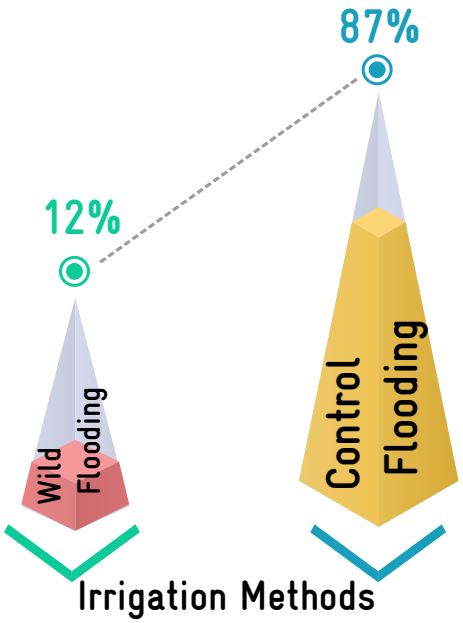


Figure 3.25. Irrigation methods

3.6.2.10 Means of water extraction

In the Block water is extracted by two ways gravity and lifting from the sources. The 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 District, since the dependence on ground water sources are more, 95 % of the water extraction methods are under lifting means of extraction and only 5 % comes under gravity means of water extraction (Figure 3.26).

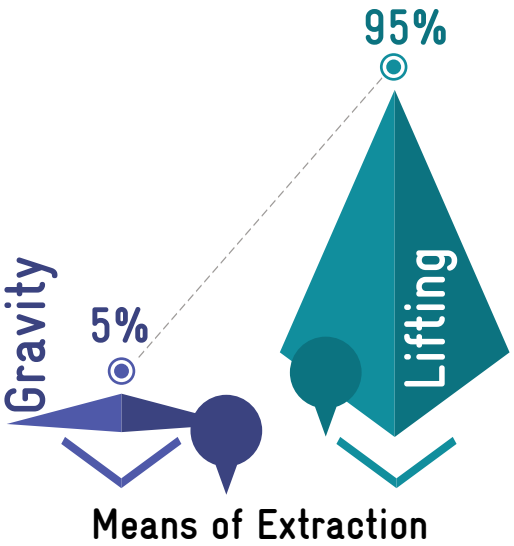


Figure 3.26. Means of water extraction

3.6.2.11 Livestock details

Block withnessed the total lovestock population of 83,514 which includes, cattle, sheep and goats. The small ruminants such as sheep and goat constitute 29.29 % and 16.20 % of the total livestock. While cattle population is higher in this Block at 54.50% (Figure 3.27). The total water requirement for livestock is 170 ha.m. Of the total water demand, 88 % is met through ground water and remaining 12 % is from surface water resources.

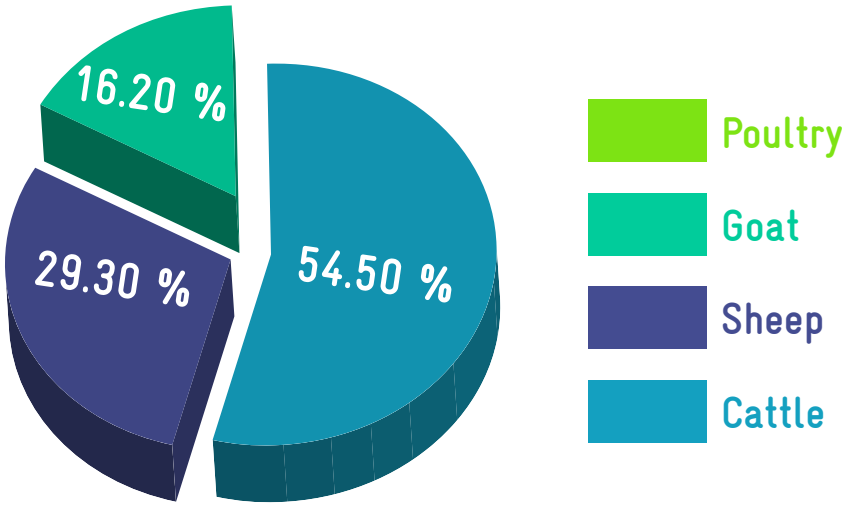


Figure 3.27. Livestock details

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 number of MGNREGA job holders is also analyzed. Table 8 lists demographic and socio-economic status of Arni Block. GP wise demographic and socio-economic status are attached in Annexure 3.8.

TABLE 8. CWRM PARAMETERS BASE SOCIO-ECONOMIC STATUS IN THE BLOCK

Sl. No	Socio-economic Parameter	Total
1	Geographical Area	18,890
2	Male Population	57,471
3	Female Population	57,493
4	Total Population	1,13,161
5	SC Population	24,412
6	ST Population	510
7	Vulnerable popupation	24,922
8	Households (HH's)	40,979
9	Only one room HH's (SECC)	4,775
10	Female Headed HH's (SECC)	2,482
11	Vulnerable Households (SECC)	4,086
12	% of Vulnerable Households	11
13	Registered MGNREGA Job cards	38,105

14	Active person working in MGNREGA job Cards	28,209
15	Drinking Water Sources	25,001
16	HH's have tap water connection for drinking water	3,060
17	HH's dependent on other sources for drinking water	4,436
18	Annual Greywater Generation	207

3.7.1 Population:

The total population of the Block is 1.13 Lakhs*, of which the proportion of female are slightly higher than men (Figure 3.28). In the CWRM planning process due attention is given for the intersecting variables such as gender, class, caste and marital status and availability of safe drinking water resources. In the Block, about 22 % of the total population constitute vulnerable population.

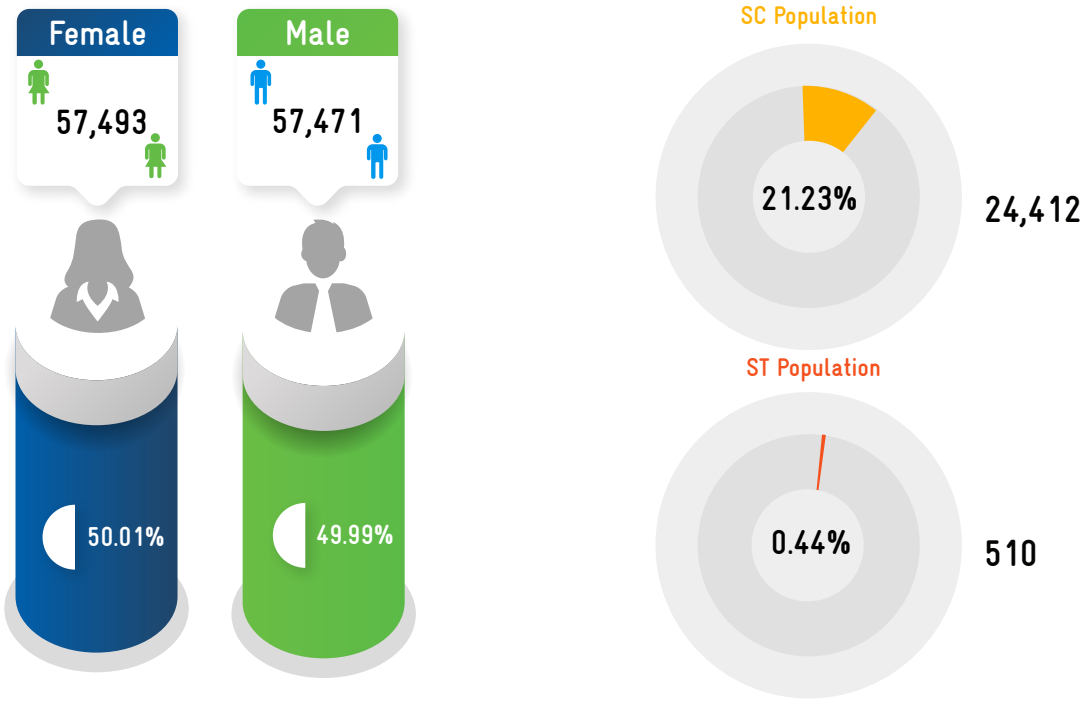


Figure 3.28. Population details

**Population figure differs from Census 2011 due to categorization of GPs based on revenue panchayat boundaries*

3.7.2 Households

There are a total of 40,979 households in which 11.65 % households have only one room, 6 % households are headed by women and 10 % are vulnerable households (Figure.3.29).

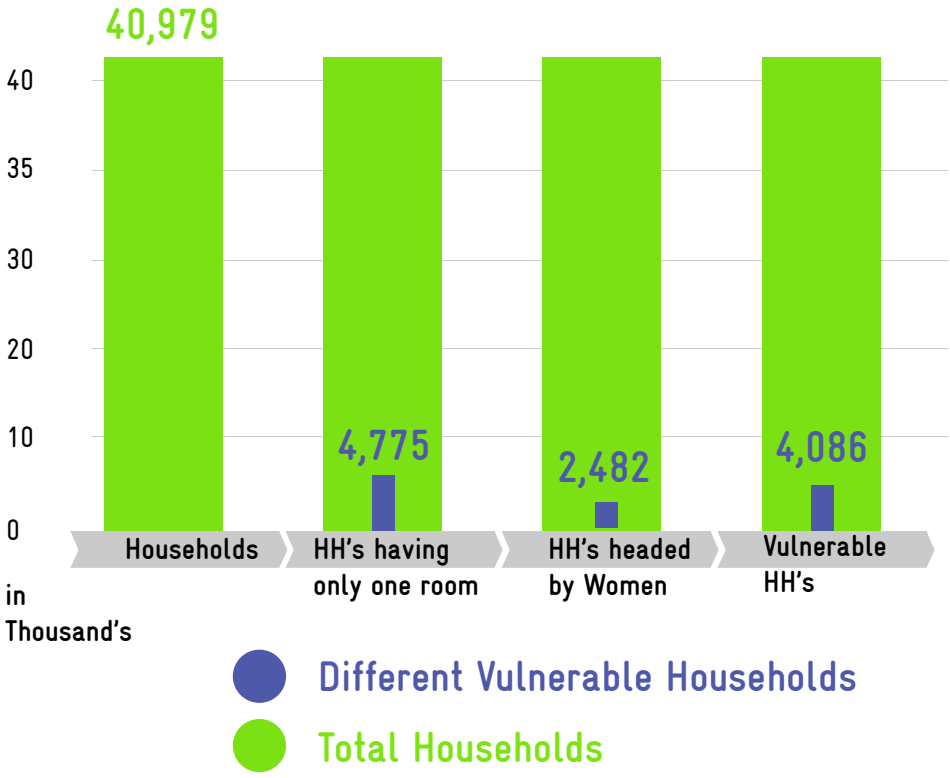


Figure 3.29. Details of Households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 1.13 Lakhs, 33.67 % are registered for job cards in Mahatma Gandhi NREGA scheme, in which 74 % of the job cards are in active category (Figure 3.30).

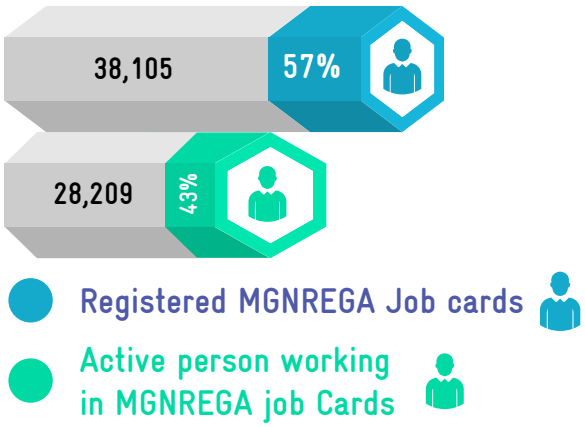


Figure 3.30. Status of MGNERGA job cards

3.7.4 Drinking Water Sources

Only 3,060 households have tap water connection and 4,436 households depend on other water sources for domestic use, where other sources included RTRWHS / Tanka (Roof Rain water harvesting systems, hand pump, open wells, bore wells, tank/ pond/ oorani, springs and river/ streams.

Tap water connection

3,060
Households

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

4,436
Households

3.7.5 Annual Greywater Generation

The grey water generation estimated across this Block is 207 ha.m which is available for reuse or recycle.

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

Morphology

Puthur, Mullandram, Poosimalaikuppam

Wasteland

Ariyapadi, Sirumur, Su vanam, Panaiyur, Kanikilippai, Mullandram

Soil erosion

Vedugasathu, Adaiyapulam, Suvanam, Ariyapadi

Upland/Slope

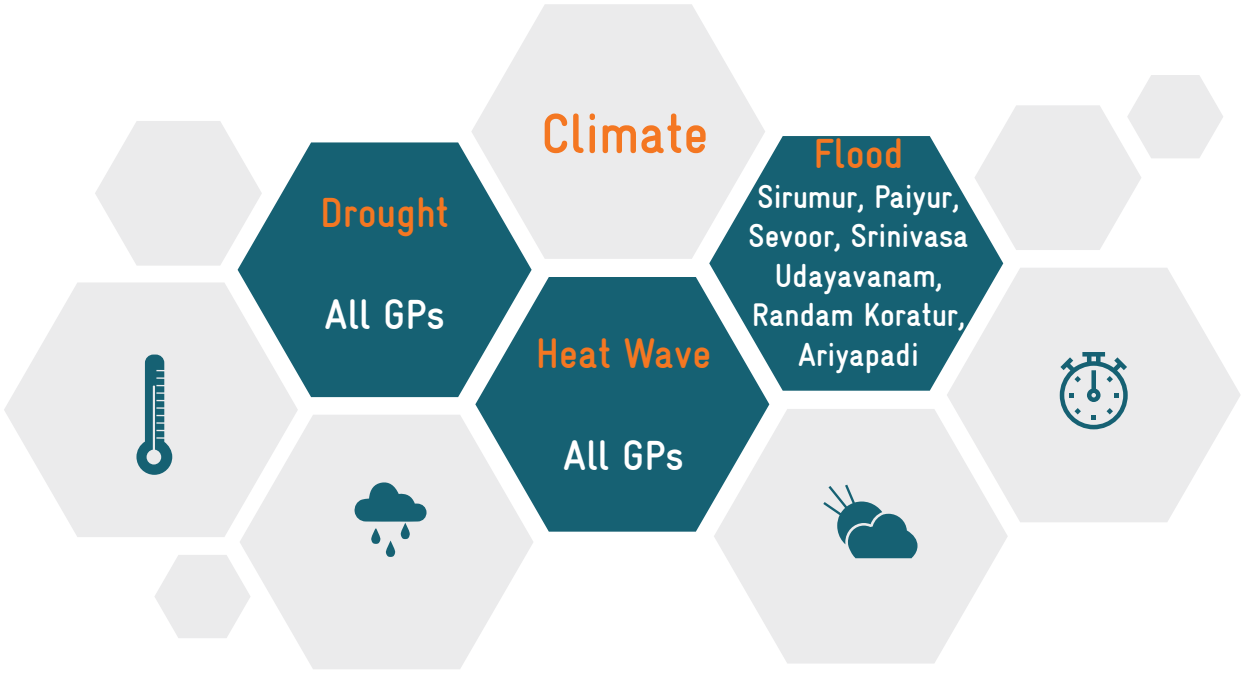
Irumbedu, Ladavaram, Adaiyapulam, Randamkurattur, Vedugasathu

Ground water prosperity

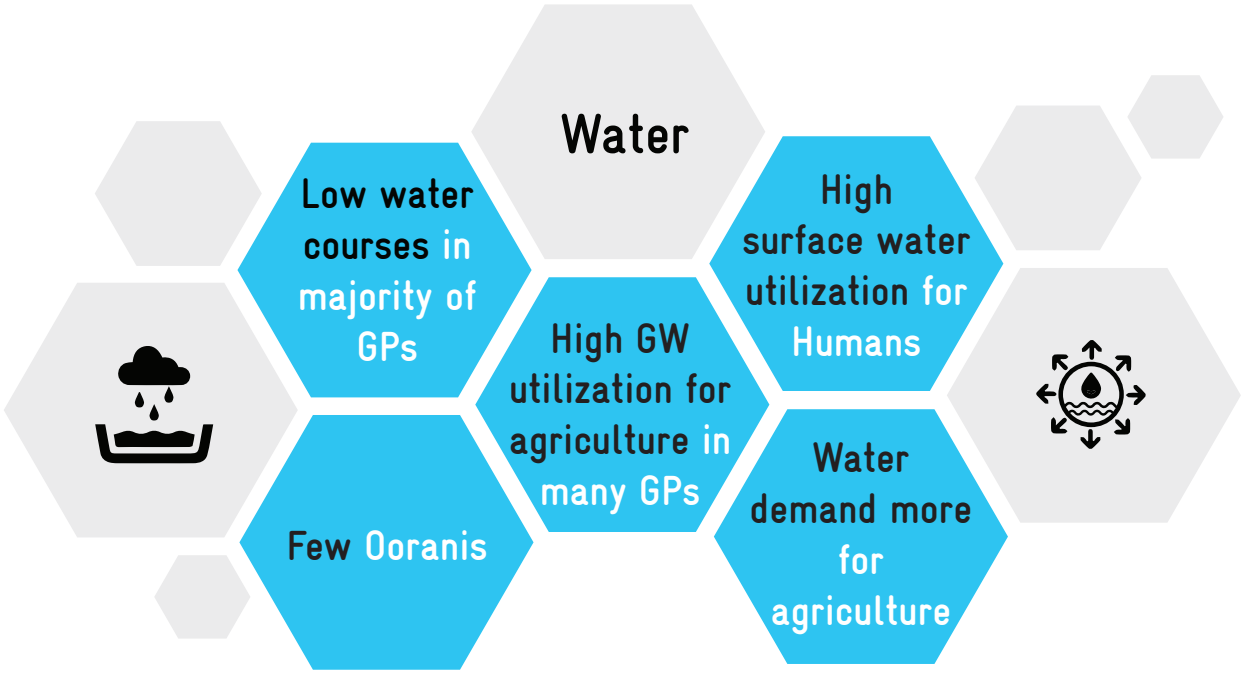
Mullandram, Morrappanthangal

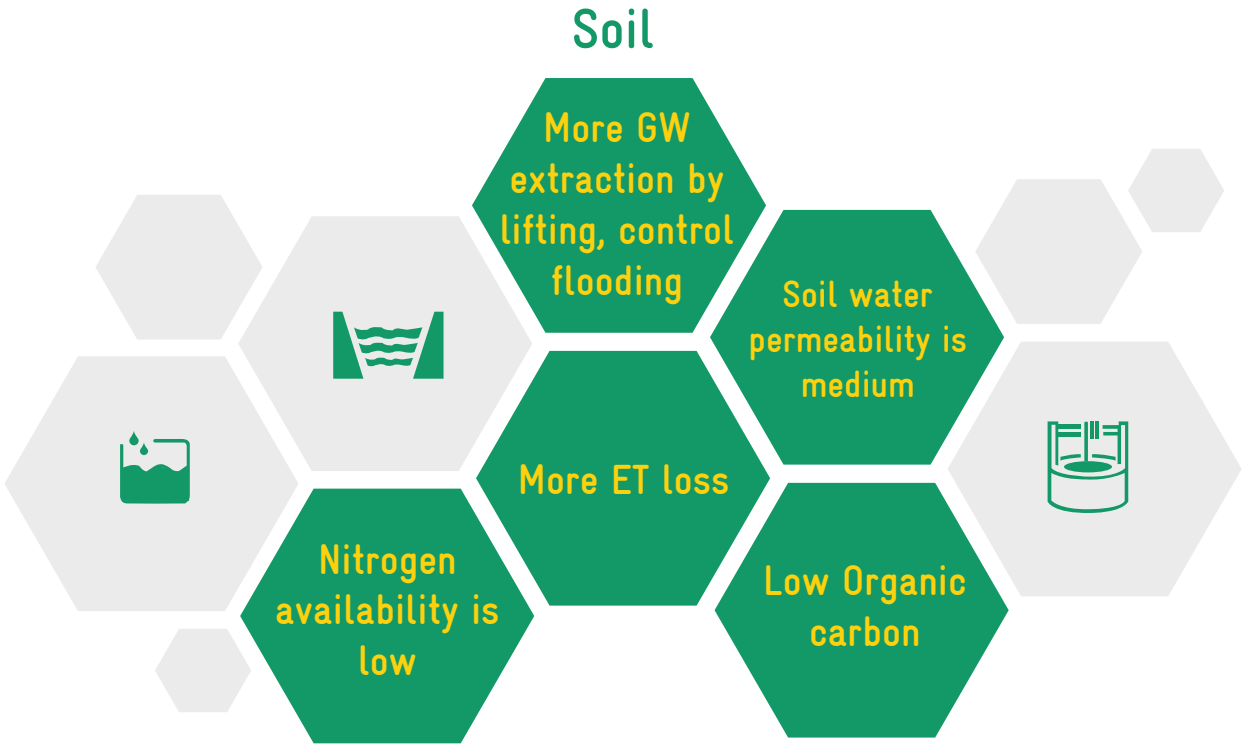
Salt affected area

Panaiyur, Katteri


Climate
Drought
All GPs
Flood
Sirumur, Paiyur, Sevoor, Srinivasa Udayavanam, Randam Koratur, Ariyapadi
Heat Wave
All GPs


Socio economic
Population density high in Sathiyavijayanagaram
Vulnerable population high in Paniyur, Paiyur, Irumbedu
% of vulnerable households high in Pudupattu, Vilai, Nesal
No. of households and female headed households high in Adaiyapulam, Chitheri, Velapadi, Kalleripattu
Total population, Female population, Only one room households high in Sathiyavijayanagaram, Vedugasathu
Grey water generation more in Savoor, Paiyur, Paniyur
Only 7 % of HH's have tap water connection for drinking water
Registered MGNREGA job cards and active persons working are low in Nethapakkum, Velleri


Water
Low water courses in majority of GPs
High surface water utilization for Humans
High GW utilization for agriculture in many GPs
Few Ooranis
Water demand more for agriculture


Soil
More GW extraction by lifting, control flooding
Soil water permeability is medium
More ET loss
Nitrogen availability is low
Low Organic carbon

கெடுப்பதூஉம் கெட்டார்க்குச் சார்வாய்மற் றாங்கே
எடுப்பதூஉம் எல்லாம் மழை

குறள் - 15

Destruction it may sometimes pour
But only rain can life restore

Thirukkural - 15

CHAPTER 4

4 VULNERABILITY RANKING OF GP

The vulnerability assessment has been carried out using IPCC methodology. 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).

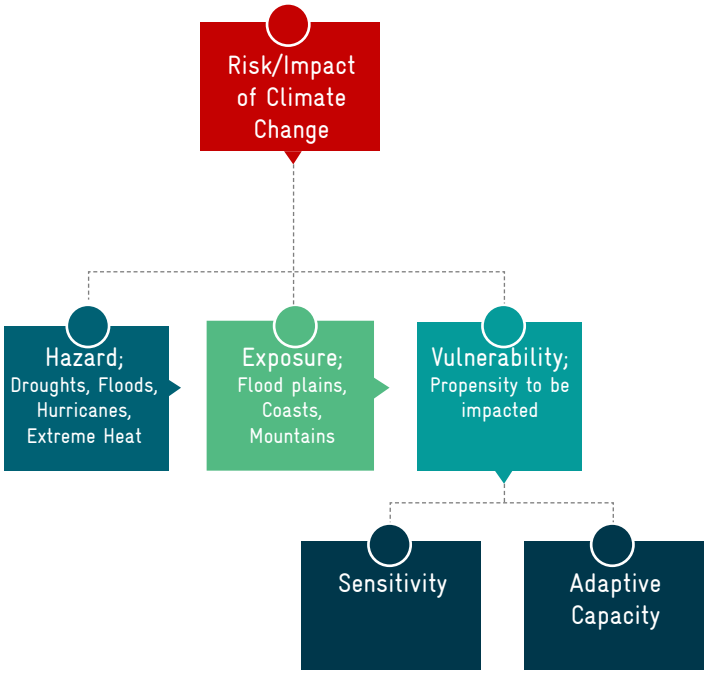


Figure 4.1. Vulnerability of the system as defined by IPCC

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 have been explored through rigorous study were considered here to address the key water challenges at GP level. About 70 spatial and non-spatial parameters/ indicators under 4 dimensions via climate (3), water (25), agriculture (31) and sociodemographic (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.

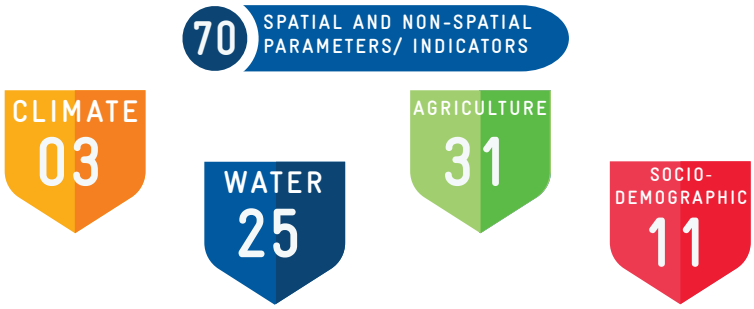


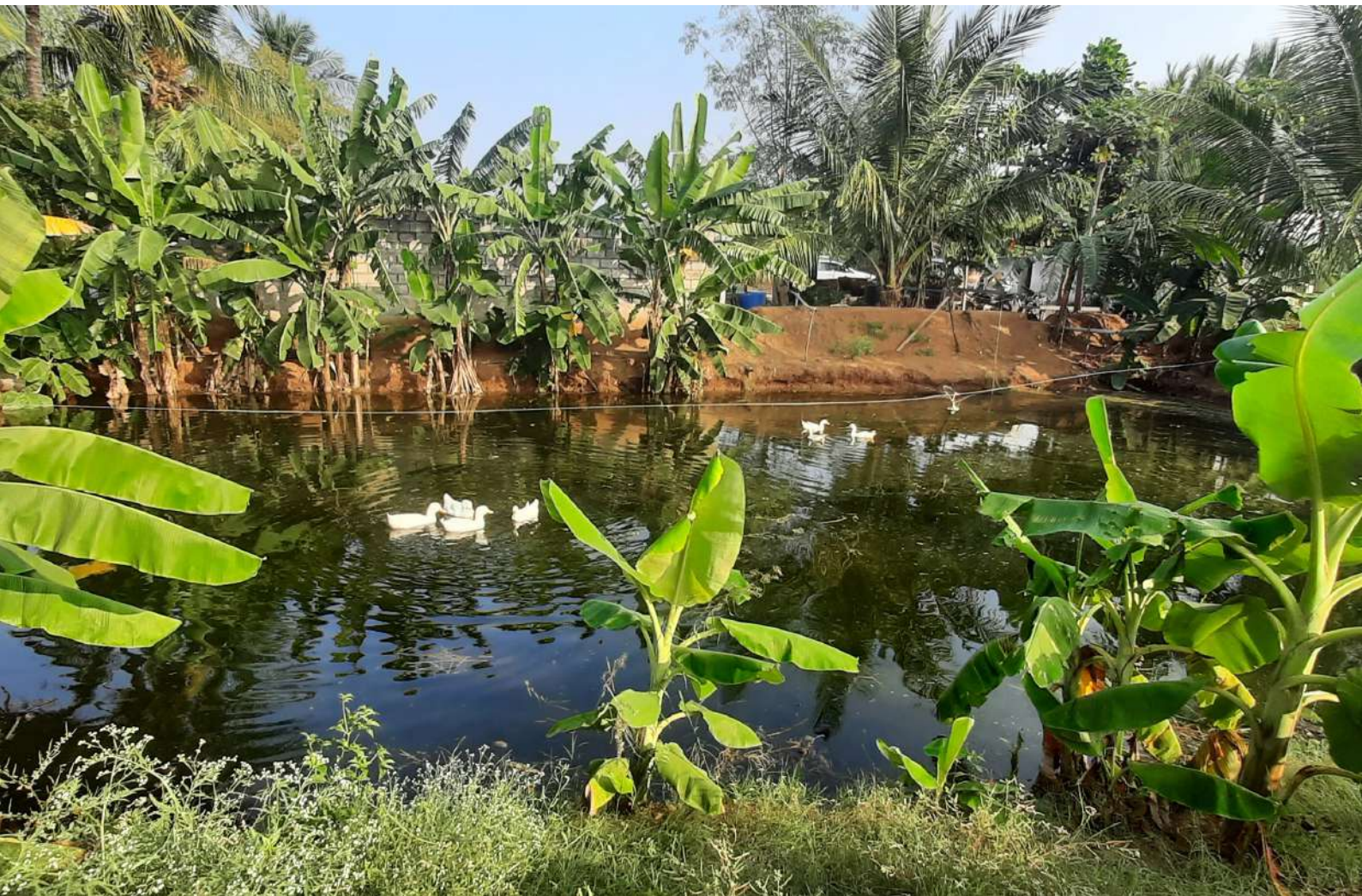
TABLE 9. CWRM PARAMETERS SELECTED FOR BLOCK LEVEL VULNERABILITY

	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	
Agriculture	**Area under land resources (in ha)**	
	Forest land	Adaptive capacity
	Non-Agricultural Uses	
	Barren & Un-cultivable Land	
	Permanent pastures and Other grazing land	
	Land under miscellaneous tree crops etc.	
	Cultivable wasteland	
	Fallows land other than current fallows	Sensitivity
	Current fallow land	
	Unirrigated land	
	Area irrigated by source	

Agriculture	**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	
	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 level as very high, high, medium, low, and very low. The vulnerability assessment methodology is given in Annexure 4. GP Sirumur has witnessed with higher CVI value of 0.596 followed by Vettiyantholuvan ad Ariyapadi while low CVI for Kanigiluppai GP (Figure 4.2).

Upto	Category	Color range
0.571	Very High	
0.546	High	
0.521	Medium	
0.497	Low	
0.472	Very low	



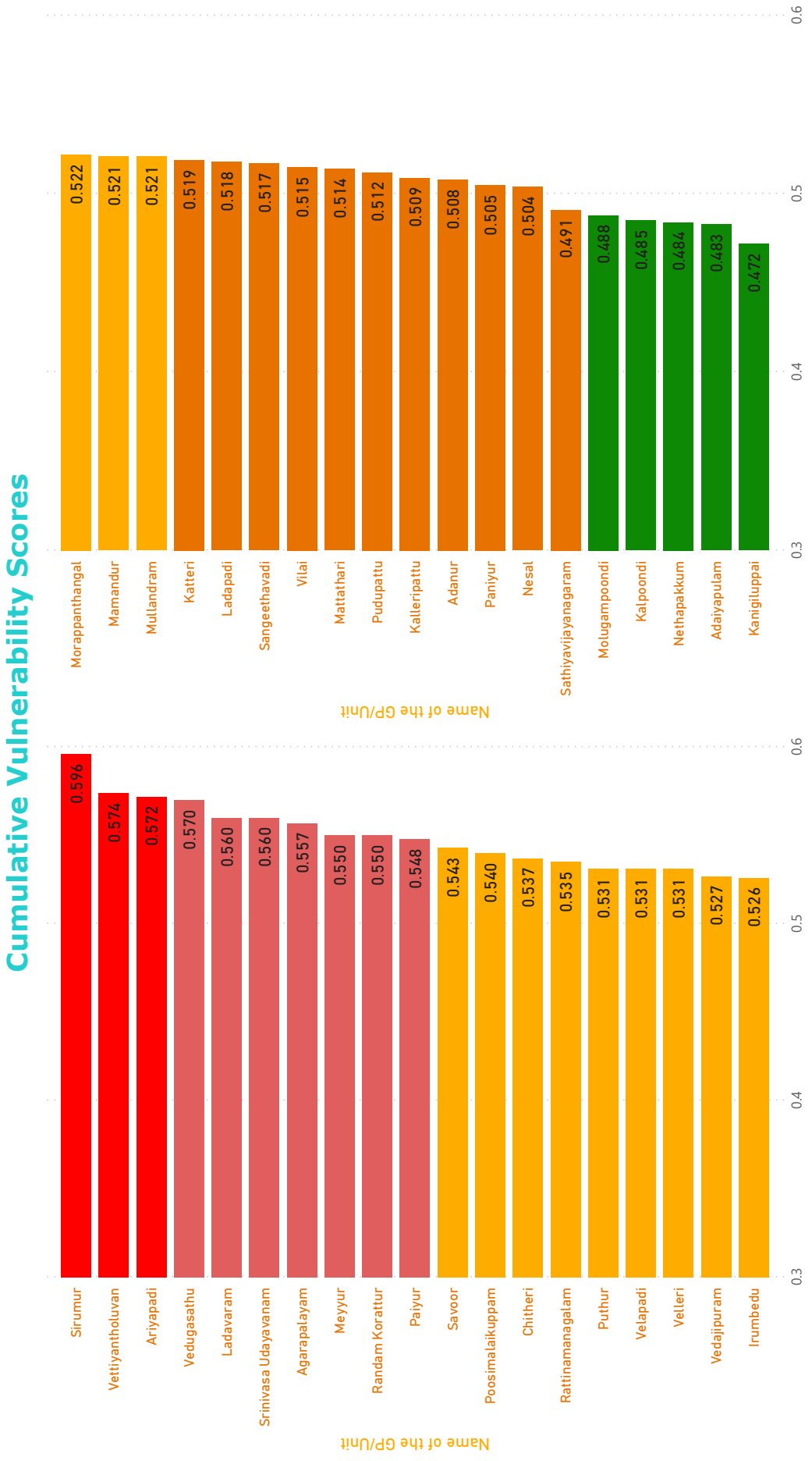


Figure 4.2. Final cumulative vulnerability scores

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 GP wise vulnerability dimensions

Climate risks vulnerability

In the last decade all GPs of the Block are affected by climate risks such as droughts and heatwaves. While Sirumur, Paiyur, Sevoor, Srinivasa Udayavanam, Randam Koratur and Ariyapadi GPs are vulnerable to flood.

SIRUMUR, PAIYUR, SEVOOR, SRINIVASA UDAYAVANAM, RANDAM KORATUR, ARIYAPADI

Water resource vulnerability

The water resources vulnerability index shows that Ariyapadi GP is highly vulnerable followed by, Vettiyantholuvan, Sirumur, Savoor, Vedugasathu GPs.

ARIYAPADI, VETTIYANTHOLUVAN, SIRUMUR, SAVOOR, VEDUGASATHU

Agriculture resources vulnerability

In agriculture and allied sectors, Poosimalaikuppam GP has highest vulnerable score followed by Vettiyantholuvan, Meyyur, Ariyapadi, Sirumur, Agarapalayam, Chitheri, Ladapadi GPs.

POOSIMALAIKUPPAM, VETTIYANTHOLUVAN, MEYYUR, ARIYAPADI, SIRUMUR, AGARAPALAYAM, CHITHERI, LADAPADI

Socio-economic vulnerability

Pudupattu GP has very high vulnerable score followed by Mullandram, Ladavaram, Sathiyavijayanagaram, Paiyur, Mattathari and Vilai GPs.

PUDUPATTU, MULLANDRAM, LADAVARAM, SATHIYAVIJAYANAGARAM, PAIYUR, MATTATHARI, VILAI

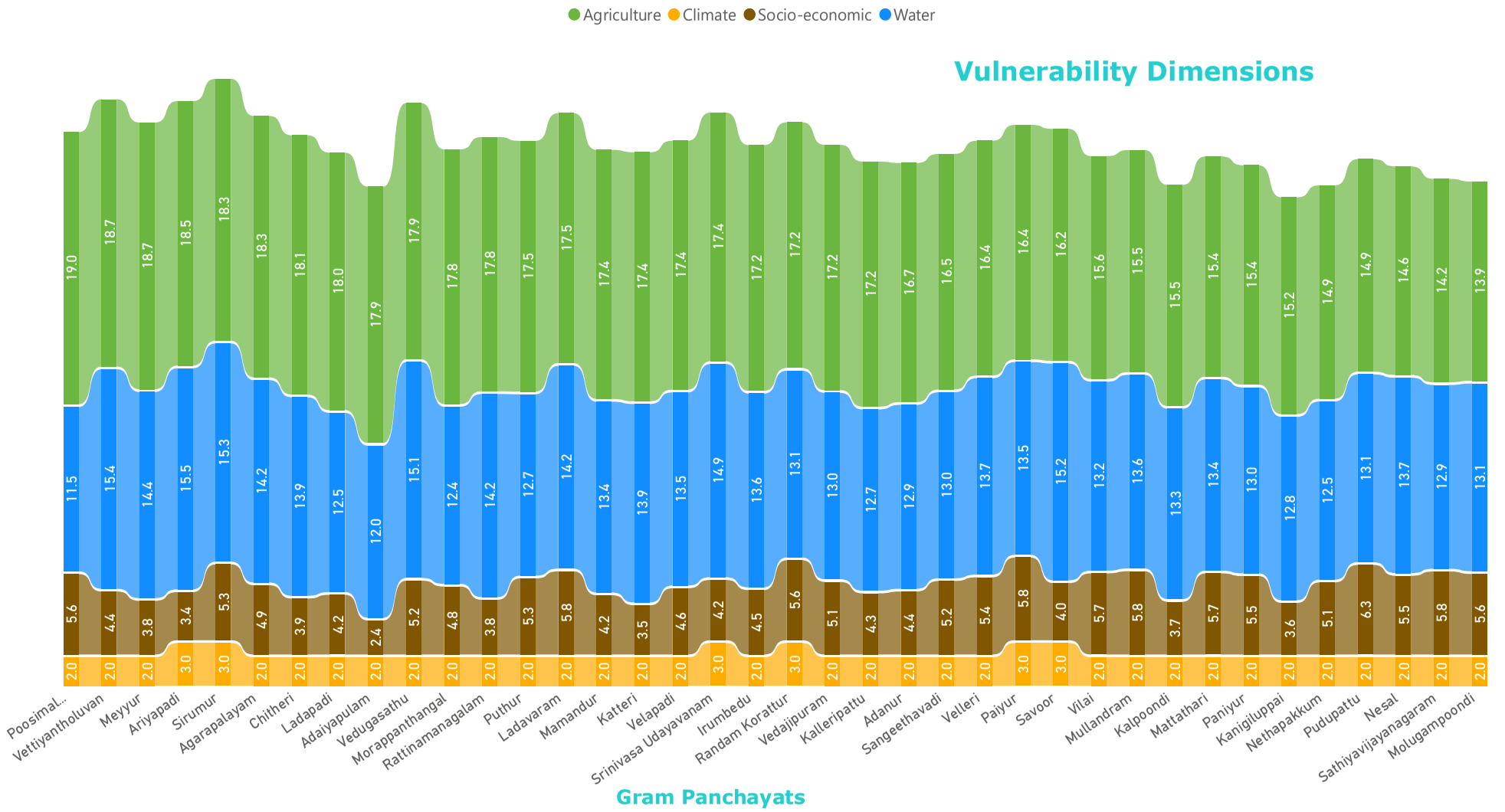
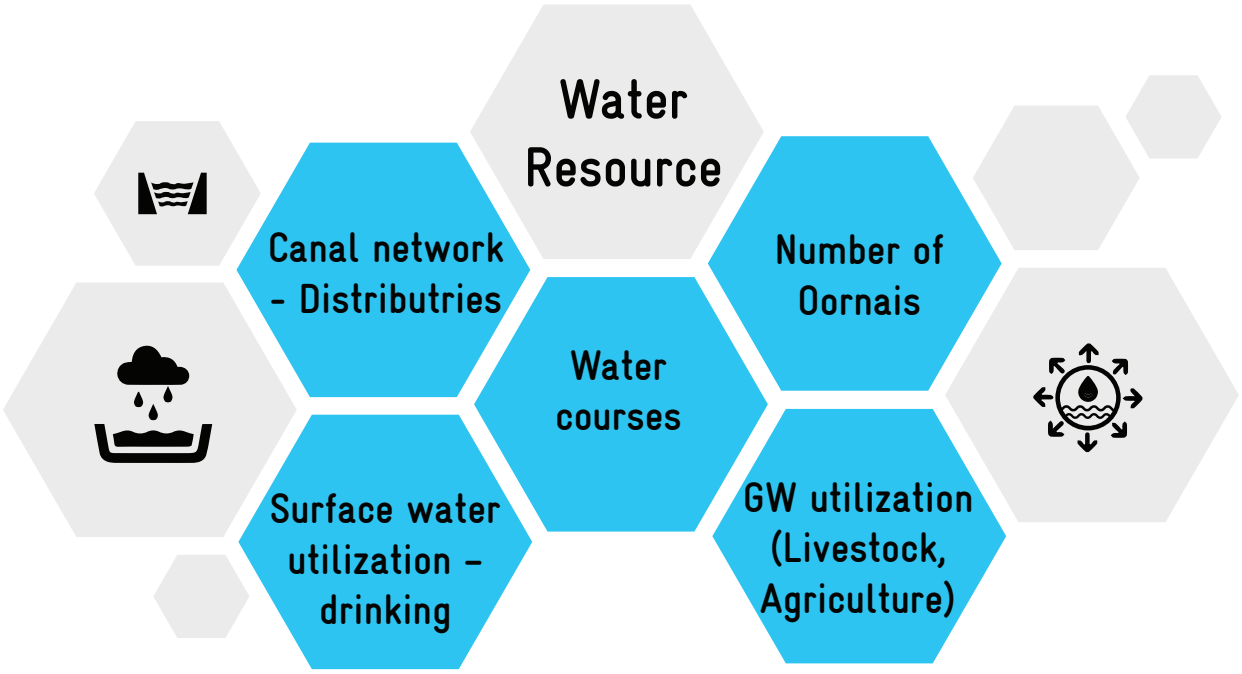
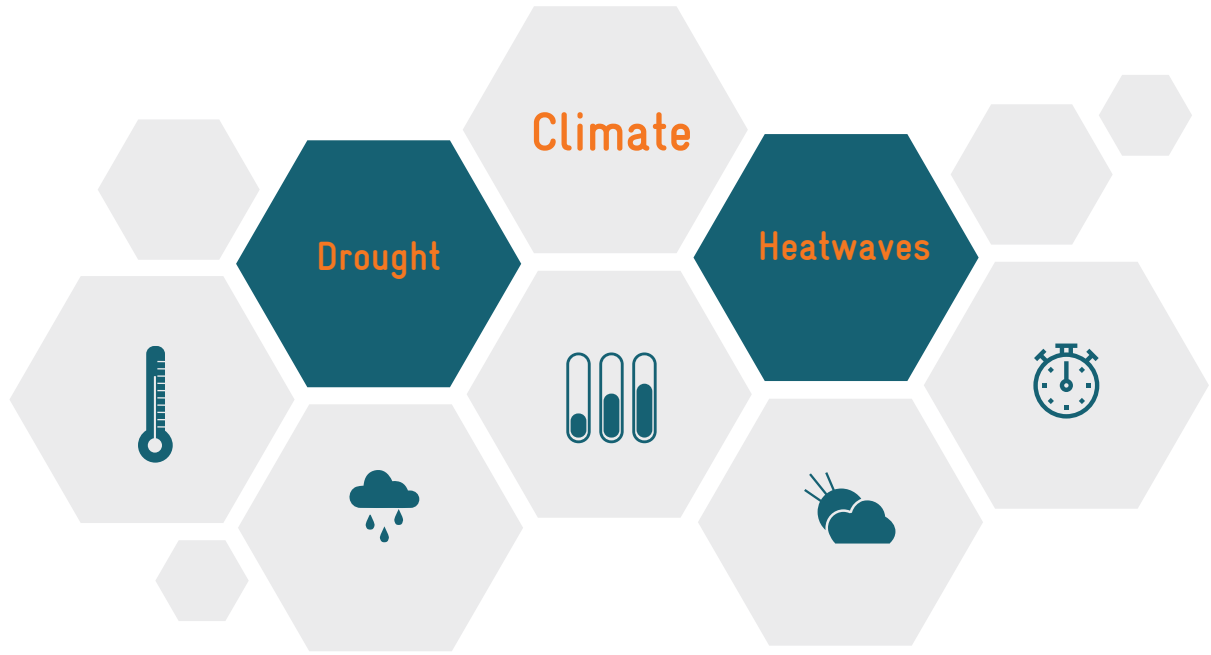
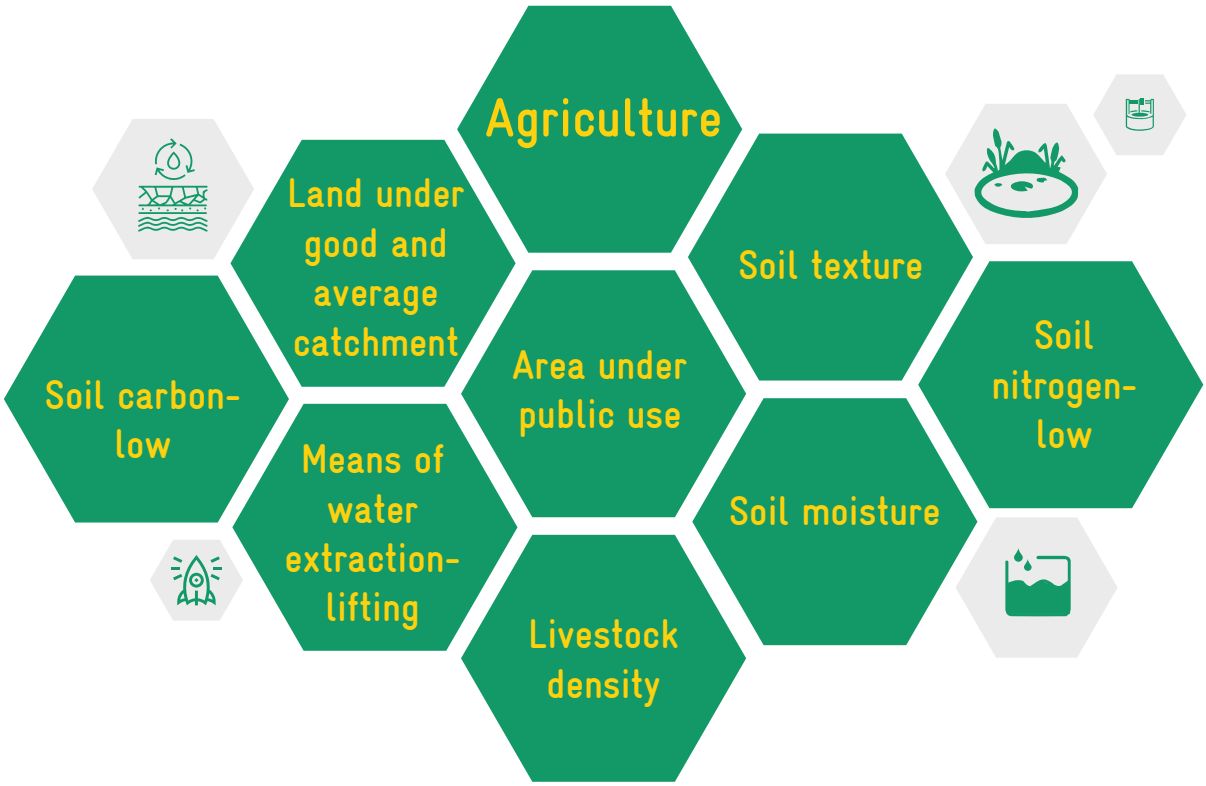


Figure 4.3. GP wise vulnerability dimensions

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 KEY WATER ACTIONS UNDER MAHATMA GANDHI NREGS CONVERGENCE

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 enables 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). This chapter discusses the proposed treatment actions under WASCA, CWRM and CRM.

5.1 THE PROPOSED AREA UNDER WASCA TREATMENT

Out of 30,886 ha available land in Arni Block, 4,529 ha (14 %) area is proposed for treatment under WASCA TN– CWRM planning. A large portion of key water actions area proposed is in irrigated land and few proposals for unirrigated land. The detailed land wise proposal for WASCA treatments is given in Table 10. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 10. PROPOSED AREA FOR WASCA TREATMENT

Land Use	Total available land (ha)	WASCA proposed Treatment Area (ha)
Barren & Un-cultivable Land	10,376.32	7,782.28
Cultivable Waste Land	612.35	459.28
Current Fallow land	6,704.80	765.66
Fallows Land other than Current Fallows	1,409.23	135.14
Land Under Miscellaneous Tree Crops etc.	2.81	2.11
Non-Agricultural Uses	5,596.47	563.27
Permanent Pastures and Other Grazing Land	51.29	38.48
Unirrigated Land	2,376.11	281.01
Area Irrigated by Source	6,742.65	666.35

The highest of 72.78 % of Barren, Un-cultivable land was considerd and proposed for water treatment under WASCA followed by cultivable wasteland of 4.29 % while least land under miscellaneous tree crops etc. area was considered (Figure 5.1).

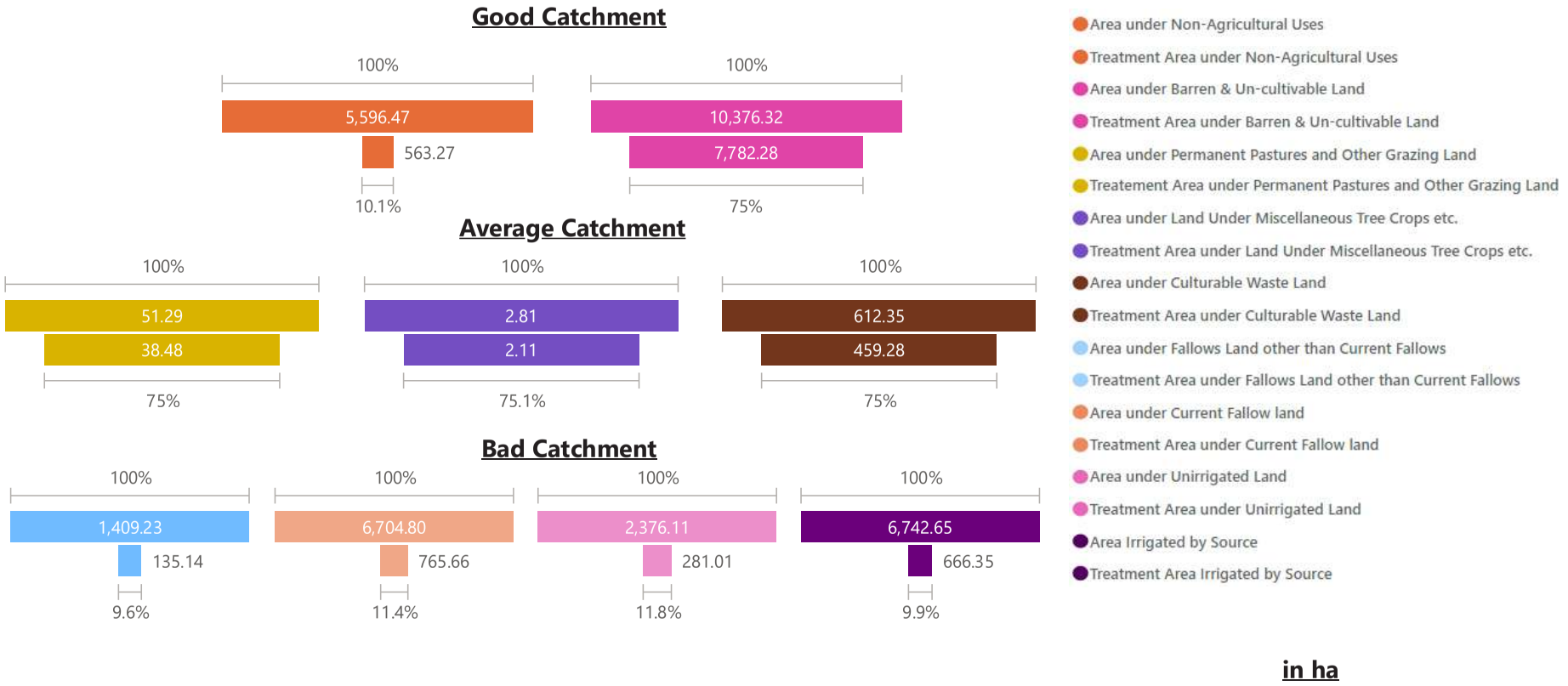


Figure 5.1. WASCA treatment area in percentage

Expected Runoff Conservation after WASCA treatment

The productive developmental activities are designated as key water actions in WASCA proposed area. With the above proposed treatment area, the expected runoff harvested due to WASCA intervention would be around 4,020 ha.m which is 42 % of the total runoff. Of which the expected runoff conservation of 77.63 % comes from good catchment area followed by 21.58 % from bad catchment area and rest is from average catchment area (Figure 5.2).

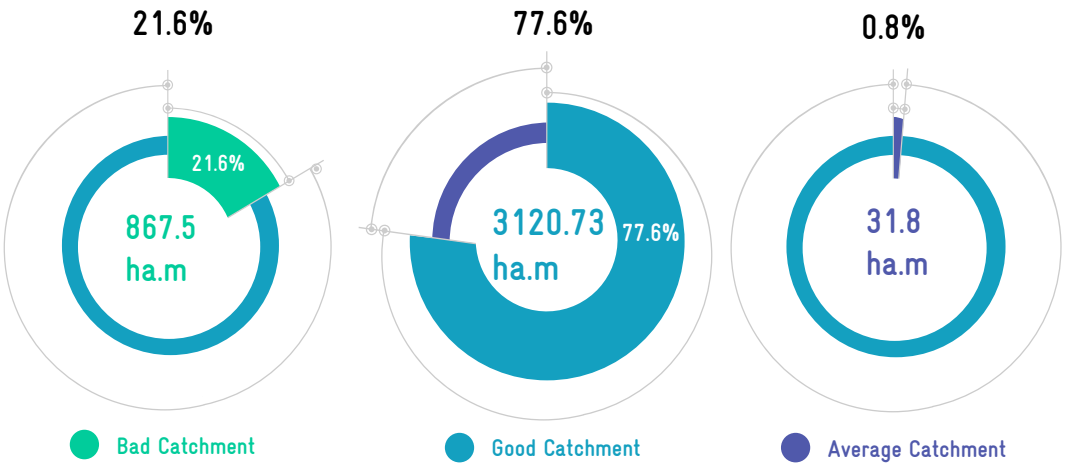


Figure 5.2. Expected conservation after WASCA treatment

The graphical representation of GP wise expected runoff conservation after completion of WASCA treatment is shown in Figure 5.3 and tabulated in 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)
Farm Bunding with Boundary Trenches - Individual	FBBT (ha)	489	1,218
Land development - Individual	LD (ha)	1,279	3,194
Construction of new open wells & Recharge Shafts	COWRS (No.)	926	-
Dry land Horticulture/Agro-forestry - Individual	DLHA (ha)	5,52,404	723
Nursery Development	ND (No.)	86,659	17,331
Avenue plantation(km)	AVP (m)	-	300
Canal Bund Plantation	CBP (ha)	16,322	72,817
Contour Continuous Bunds (CCB) for Afforestation area	CCB (m)	99,716	555
Linear Plantation(km)	LP (m)	14,078	70,418

Micro Irrigation	MI (ha)	168	440
Afforestation in Public/common lands	Aff (ha)	52,06,350	6,509
Block Plantation (Community)	BP (ha)	6,17,827	774
Irrigation Channel Plantation	ICP (m)	4,231	21,164
Composting	Co (No.)	288	1,234
Silvi-pasture Development	SPD (ha)	64,200	81
Soak Pits (Community)	SP (No.)	282	-
Soak Pits (Individual)	SPI (No.)	2,709	-
Cattle Shelters	CS (No.)	1,376	-
Cattle Trough	CT (No.)	1,376	-
Fodder development - Community & Individual	FD (ha)	-	2,040
Azolla units - Individual	AZ (No.)	1,383	-
Drainage Line Treatment (DLT)	DLT (m)	18,921	94,604
Goat Sheep Shelters	GSS (No.)	1,079	-
NADEP Vermi compost	NADEP (ha)	1,376	-
Construction of Farm Ponds - Individual	FP (No.)	510	-
Restoration of water bodies:PWD Tanks	RWBT (No.)	96	-
Restoration of water bodies:Ooranis	RWBO (No.)	3	-
Water Course - Irrigation Channels - Desilting	WCICD (m)	4,231	21,164
Restoration of water bodies:Ponds	RWBP (No.)	103	-
Roof Rain Water Harvesting	RRWH (No.)	76	-
Artificial Recharge Structure	ARS (No.)	98	246


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 5,134 ha area
More than 1.9 Lakhs plants planting
5,117 sites for WCWH
1 Lakh livelihood works

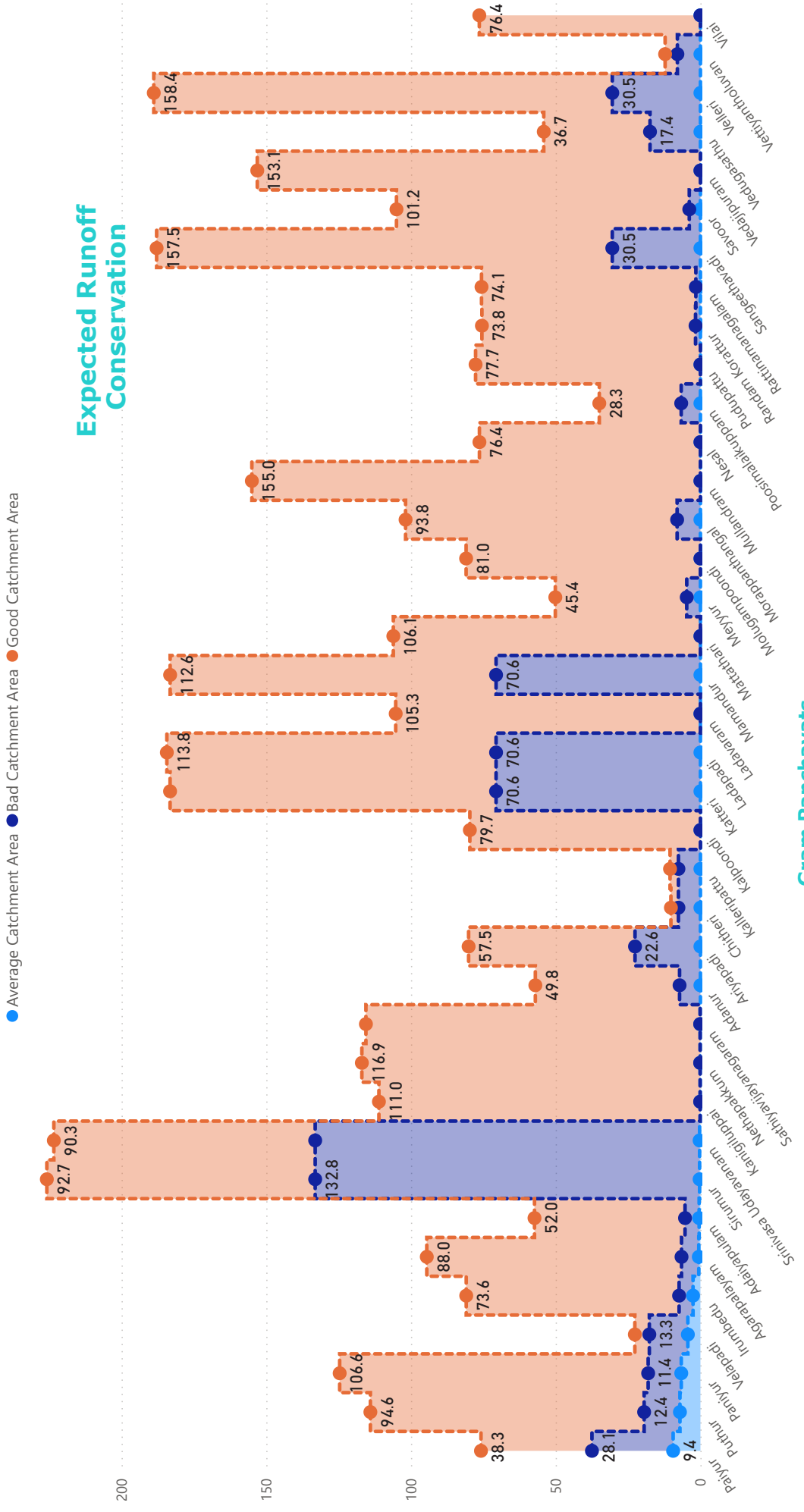


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

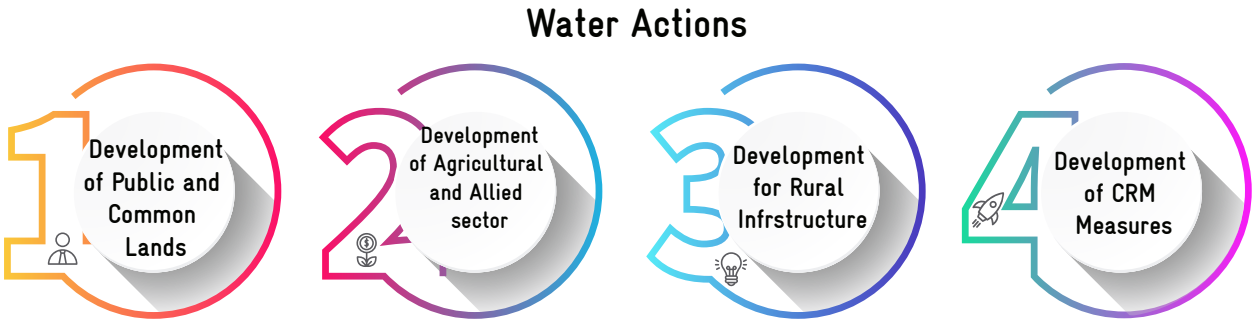
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

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 land development, tree plantation, restoration of waterbodies etc., which are listed in Table 11 and selected suitable sites can be visualized in 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)	8,931.4	10	0.025	223.29	89,314
COMPOSTING(NUMBER OF UNITS)	684	15	0.17	116.28	10,260
AFFORESTATION IN PUBLIC/ COMMON LANDS(ha)	5,206	3344	8.6	44,771.60	1,74,08,864
BLOCK PLANTATION (COMMUNITY)(ha)	254	4320	11.1	2,819.40	10,97,280
SILVI-PASTURE DEVELOPMENT(ha)	175	6,664	17.1	2,992.50	11,66,200
LINEAR PLANTATION(km)	0.1	703	1.8	0.25	98
CANAL BUND PLANTATION(ha)	846	2,930	7.5	5,281	20,23,650
IRRIGATION CHANNEL PLANTATION (m)	50.3	6	0.015	0.75	302
AVENUE PLANTATION(km)	0.2	703	1.8	0.39	154
NURSERY DEVELOPMENT (NUMBER OF UNITS)	61.9	2,344	15	928.13	1,45,035
RESTOTARATION OF WATER BODIES: A) PWD AND TANKS (NUMBER)	105	800	5	525	84,000
RESTORATION OF WATER BODIES: B.PONDS (NUMBER)	-	200	2	-	0
RESTORATION OF WATER-BODIES: C. PONDS (NO.)	130	200	1	260	26,000
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	1,126	391	2.5	2,815	4,40,266
WATER COURSE - IRRIGATION CHANNELS - DESILTING (m)	50.3	3	0.0075	0.38	151
DRAINAGE LINE TREATMENT (m)	865.5	5	0.03	25.97	4,328

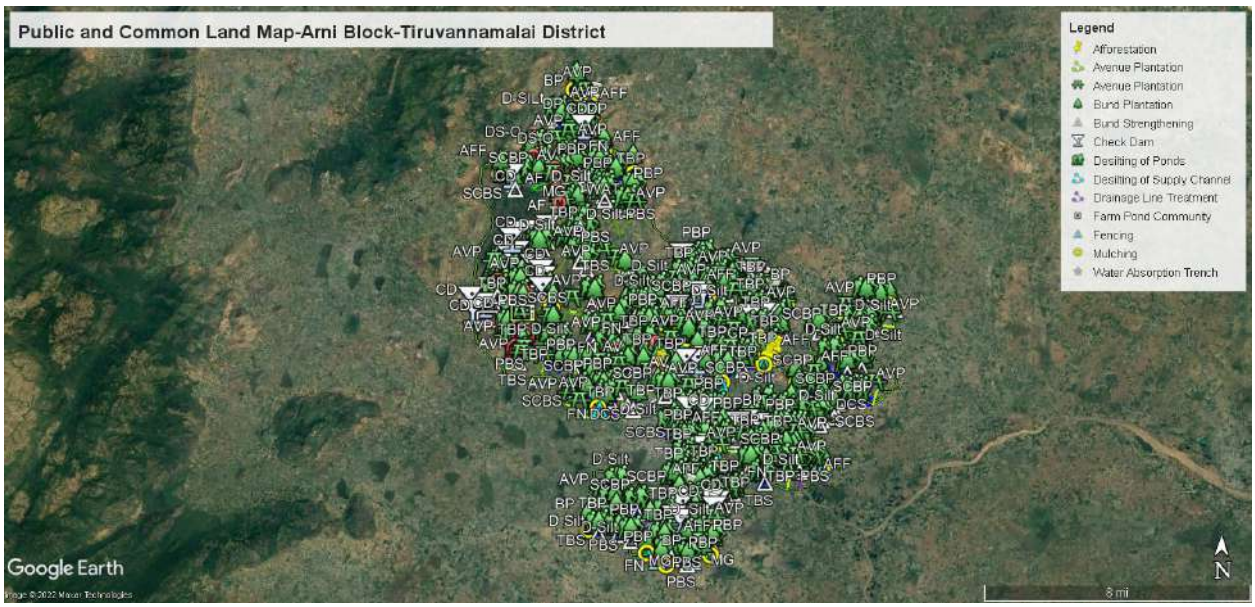


Figure 5.4. Proposed development activities in Public and Common Land

5.3 DEVELOPMENT OF AGRICULTURE AND ALLIED SECTOR

Based on the assessment, the works which enhance the agriculture and allied sectors, particularly for irrigation, soil and live stocks are proposed in the lands under individual ownership (Table 12) and selected sites can be visualize over Figure 5.5.

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

TABLE 12. DETAILS OF WORKS PROPOSED TO DEVELOP AGRICULTURE AND ALLIED SECTOR

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
FARM BUNDING WITH BOUNDARY TRENCHES - INDIVIDUAL (ha)	1,288	586	1.5	1,932	7,54,592
MICRO IRRIGATION (ha)	168	0	1	168	0
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	510	781	2	1,020	3,98,310
LAND DEVELOPMENT - INDIVIDUAL (ha)	3,194	3,906	10	31,936	1,24,74,123
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	681	3,321	8.5	5,789	22,61,601
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	1,383	23	0.15	207	31,809
NADEP VERMI-COMPOST (NUMBER OF UNITS)	1,376	27	0.18	248	37,152
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	204	2,344	1.48	302	4,78,176
CATTLE SHELTERS (NUMBER OF UNITS)	1,376	331	2.12	2,917	4,55,456
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	419	355	2.27	951	1,48,745
CATTLE TROUGH (NUMBER OF UNITS)	1,376	6	0.05	69	28,348
POULTRY SHED (NUMBER OF UNITS)	805	10	0.09	72	8,050
CONSTRUCTION OF NEW OPEN WELLS & RECHARGE SHAFTS (NUMBER OF UNITS)	1,789	926	5	8,945	16,56,614

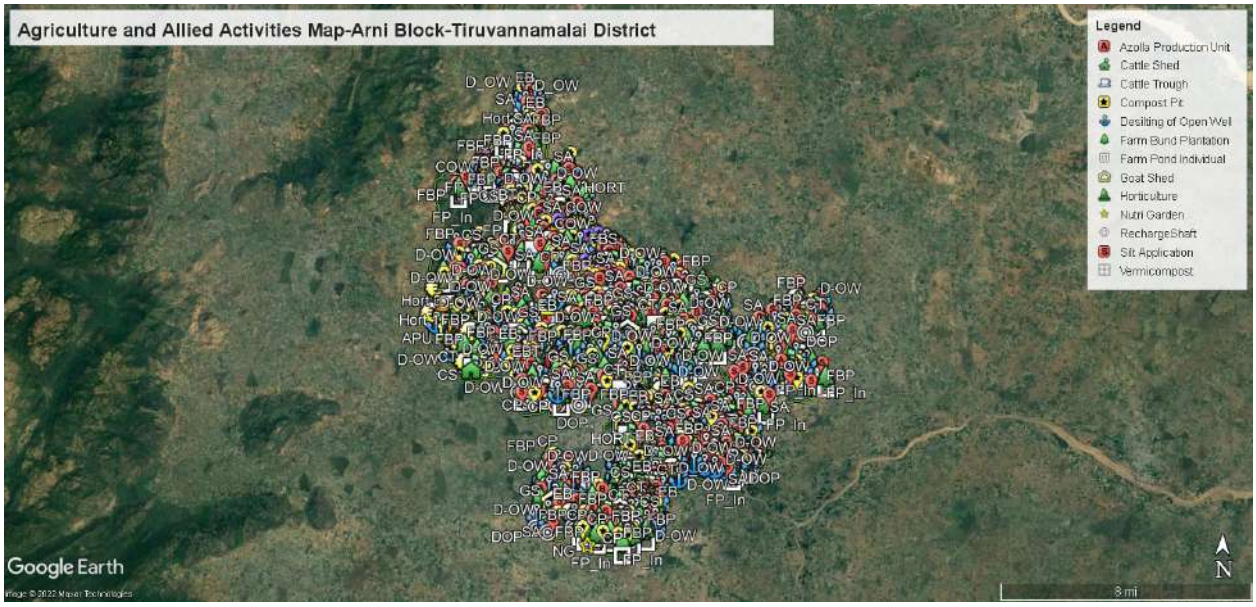


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.4 DEVELOPMENT OF RURAL INFRASTRUCTURE

The prominent works on constructing structures for water harvest 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)	307	20	0.13	39.91	6,140
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	1903	16	0.1	190.30	30,448
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	85	625	4	340	53,125

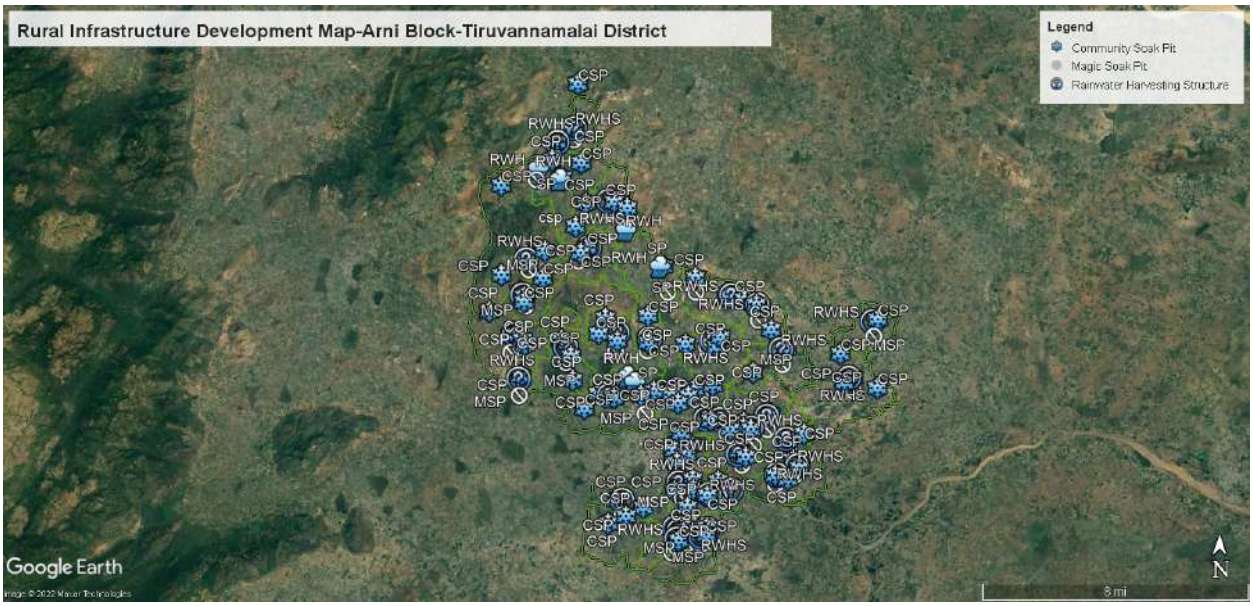


Figure 5.6. Proposed rural infrastructure activities

5.5 PROPOSED CLIMATE RESILIENCE MEASURES

Climate resilient measures are proposed to cope up with the system with future climate risks such as droughts, heatwaves and floods. As Thiruvannamalai District is one of the drought prone areas and frequently exposed to severe droughts, more measures are proposed to manage droughts and its subsequent impacts. As Arni Block is also affected by droughts and heat waves, climate resilient measures are proposed to cover-up maximum of GPs (Table 14). Figure 5.7 shows the spatial representation of proposed CRM (other farm ponds). CRM such as greening of hillocks (Table 15), silvi-pature (Table 16), bamboo plantation (Table 17), farm pond (Table 18), mini forest (Table 19) and TNIAMP farm pond (Table 20) are proposed.

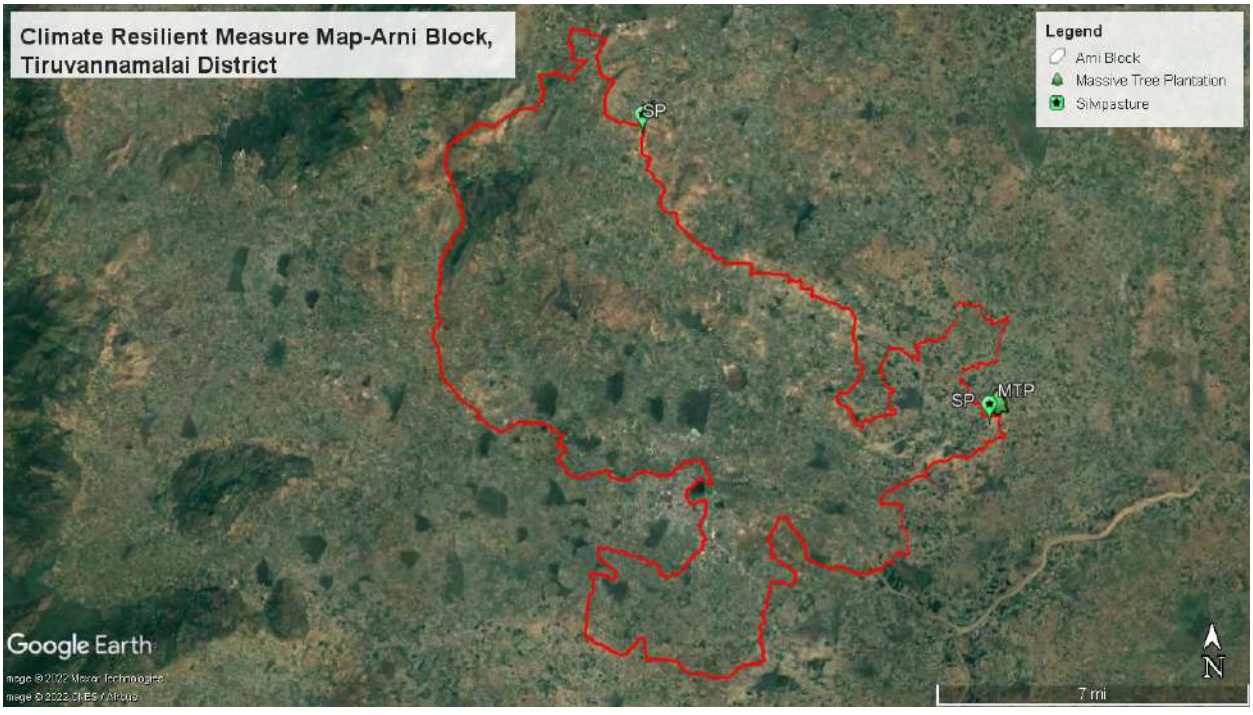


Figure 5.7. Proposed climate resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Public and Common land	Agriculture
Adanur		Farm Pond
Adayapulam		Farm Pond
		TNIAMP farm pond
Ariyapadi		Farm Pond
Ariyappadi		Farm Pond
Irumbedu	Silvi-pasture Development	Farm Pond
Kalleripattu		Farm Pond
Kalpoondi		Farm Pond
Katteri		Farm Pond
Ladapadi		Farm Pond
Ladavaram		Farm Pond
Mattadhari		Farm Pond
Mattathari		Farm Pond
Morappanthagal		Farm Pond
Morrapanthagal		Farm Pond
Mullandiram	Greening of Hillocks	Farm Pond
Nesal		Farm Pond
Nethapakam		Farm Pond
Nethapakkam		Farm Pond
Paiyur		Farm Pond
Panaiyur	Mini forest	Farm Pond
Poosimalaikuppam	Greening of Hillocks	Farm Pond
Pudupattu		Farm Pond
Puthur	Silvi-pasture Development	
Randomkorattur		Farm Pond
S V Nagaram		Farm Pond
S.U.Vanam		Farm Pond
S.V.Nagar		Farm Pond
		Bamboo plantaton
Sevoor		Farm Pond
Sirumoor		TNIAMP farm pond
Velleri		Farm Pond

TABLE 15. DETAILS OF PROPOSED ACTIVITIES ON GREENING OF HILLROCKS UNDER CRM

GP	Area in ha	Classification of land
Poosimalaikuppam	32.95	Others
Mullandiram	35.28	(Malai)

TABLE 16. DETAILS OF PROPOSED ACTIVITIES ON SILVIPASTURE UNDER CRM

GP	Habitation	Area for Plantation	No. of Plants
Irumbedu	Irumbedu	0.5	972
Puthur	Puthur	0.975	1927

TABLE 17. DETAILS OF PROPOSED BAMBOO PLANTATION ACTIVITIES UNDER CRM

Name of the GP	Survey Number	Area of plantation (in ha)	No.of Plants	Classification of Land
S.V.Nagar	1/1	8.19	20,475	Others

TABLE 18. DETAILS OF PROPOSED FARM PONDS ACTIVITIES UNDER CRM

GP	Habitation	No of farm ponds
Ariyappadi	Ariyappadi	1
Irumbedu	Irumbedu	1
Ladavaram	Ladavaram	1
Mattadhari	Mattadhari	2
Paiyur	Paiyur	1
Mullandiram	Mullandiram	4
Nesal	Nesal	1
Nethapakam	Nethapakam	3
Poosimalaikuppam	Poosimalaikuppam	2
Pudupattu	Pudupattu	2
Sevoor	Sevoor	2
Adanur	Adanur	1
Adayapulam	Adayapulam	1
Kalleripattu	Kalleripattu	1
Morrapanthagal	Morrapanthagal	1
Panaiyur	Panaiyur	1
S V Nagaram	S V Nagaram	1
S.U.Vanam	S.U.Vanam	1
Velleri	Velleri	2
Ladapadi	Ladapadi	2
Morappanthagal	Morappanthagal	1
Randomkorattur	Randomkorattur	1
Kalpoondi	Kalpoondi	1
Katteri	Katteri	1
Ariyapadi	Ariyapadi	1

TABLE 19. DETAILS OF MINI FOREST UNDER CRM

GP	Area for Plantation (In ha)	No. of Plants (1 ha - 10000 saplings)
Panayur	10.48	1,04,800

TABLE 20. DETAILS OF TNIAMP FARM POND UNDER CRM

GP	Name of Farmers	Survey No.
Adayapulam	Saravanan s/o Natarajan	47/4,5
Sirumoor	Ravichandran s/o Valliammal	244/6

நெடுங்கடலும் தன்நீர்மை குன்றும் தடிந்தெழிலி
தான்நல்கா தாகி விடின்

குறள் - 17

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

Thirukkural - 17

CHAPTER 6

PROJECTED OUTCOMES OF PLANNING

6 PROJECTED OUTCOMES OF PLANNING

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

6.1 OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

	INDICATOR	OUTCOMES/ IMPACT
1	Proportion of Land development under WASCA treatment	10,694 ha (14.6 %) of the total area treated
2	Percentage reduction of run off	4,020 ha.m i.e. 42.% of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	235 waterbodies restored
4	Area under afforestation	5,206 ha area under afforestation
5	Area under silvi-pasture development	175 ha under Silvi-pasture plantation
6	Length of drainage line treated	8,655 m length of drainage line treated

10,694 ha
AREA TREATED

4,020 ha.m
TOTAL RUNOFF HARVESTED

235
WATER BODIES RESTORED

5,206 ha
AREA AFFORESTATION

175 ha
SILVI-PASTURE PLANTATION

8,655 m
DRAINAGE LINE TREATED

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	510 farm ponds established which target the harvest of 8,97,600 cu m of water which has the potential to irrigate 179 ha area in both kharif and rabi seasons
2	Improvement in soil health	1,376 NADEP compost units for soil health improvement
3	Changes in the irrigation practices	2,127 ha Farm bunding with trenches
4	Dry land development with Agro-forestry	681 no. of works
5	Households established fodder plots	4,086 vulnerable households established fodder plots

510 FARM PONDS

1,376 COMPOST UNITS

2,127 ha FARM BUNDING WITH TRENCHES

4,086 FODDER PLOTS

681 DRY LAND DEVELOPMENT WITH AGRO-FORESTRY

6.3 OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

	INDICATOR	OUTCOMES/ IMPACT
1	No. of villages having liquid waste management systems	307 common and 1,903 individual soak pits established for recycle of grey water benefiting 40,979 households
2	Roof rain water harvesting measures	85 common roof rainwater harvesting and storage structures with a target to harvest and store 0.16 ha.m of rainwater for use
3	Nutri-garden	40,979 Households established nutri-gardens in homesteads and planted 2,04,895 saplings

307 COMMON & **1,903** INDIVIDUAL SOAK PITS

85 COMMON ROOF RAINWATER HARVESTING

40,979 NUTRI-GARDENS

2,04,895 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	6 models are identified via., greening of hillocks, silvi-pature, bamboo plantation, farm pond, mini forest and TNIAMP farm pond Greening of hillrocks in 68.23 ha 36 farm ponds in 27 GPs 2 TNIAMP farm pond 1.475 ha under silvi-pasture with 2,899 plants Bamboo plantation in 8.19 ha with 20,475 plants Mini forest in 10.48 ha with 1,04,800 plants

36
FARM PONDS

1.475 ha
SILVI PASTURE

10.48 ha
MINI FOREST

8.19 ha
BAMBOO PLANTATION

Estimated person days

The total estimated person days required for the above propose activities are 4,13,18,592 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above proposed activities is Rs 1,15,886 Lakhs as specified below Figure 6.2.

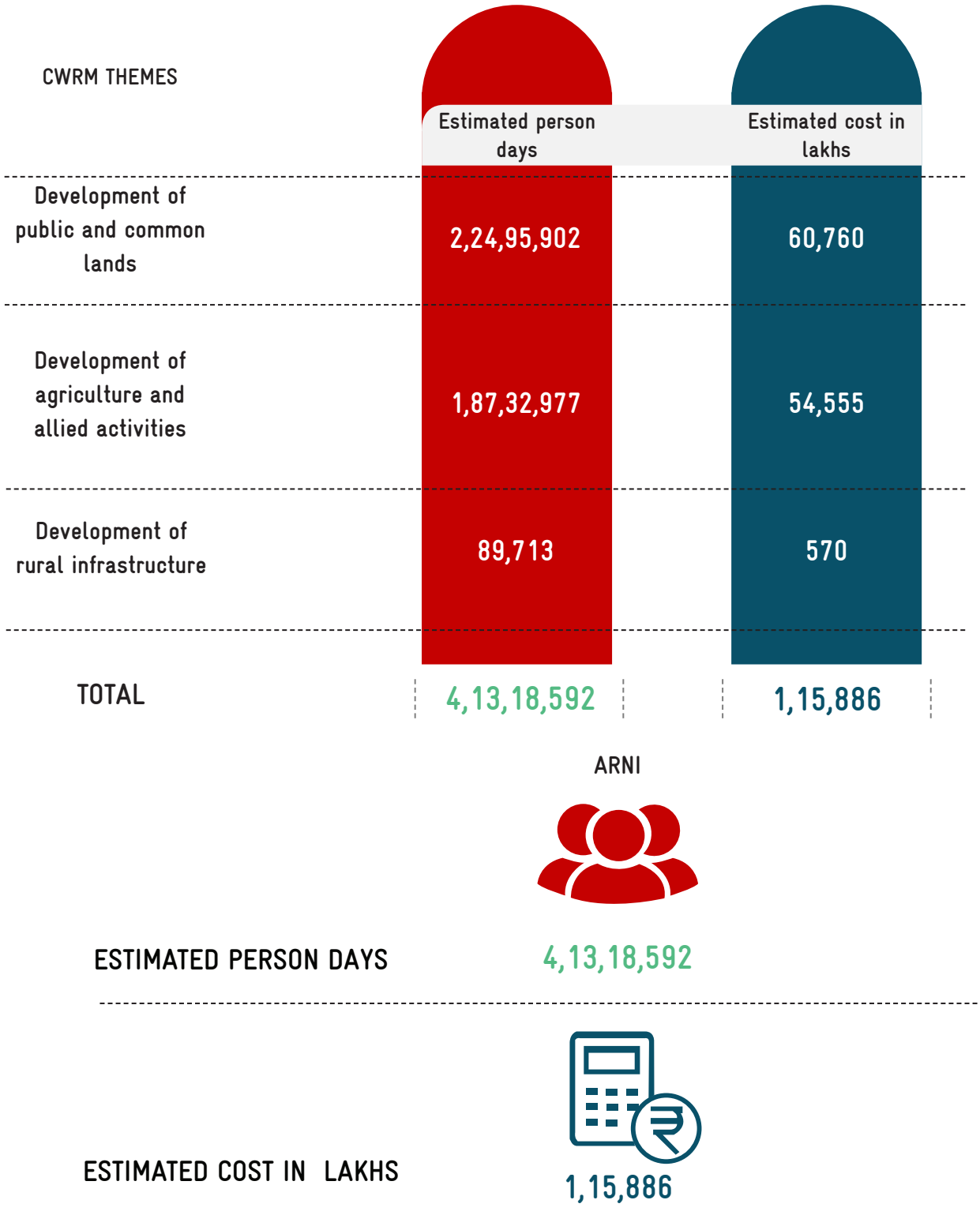


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

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 (SDG) 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 (NDCs) 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 degrees C above pre-industrial levels. Through the Paris Agreement, Parties also agreed to a long-term goal for adaptation – to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production. Additionally, they agreed to work towards making finance flows consistent with a pathway towards low greenhouse gas emissions and climate- resilient development. Nationally Determined Contributions (NDCs) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, Paragraph 2) requires each Party to prepare, communicate and maintain successive NDCs that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

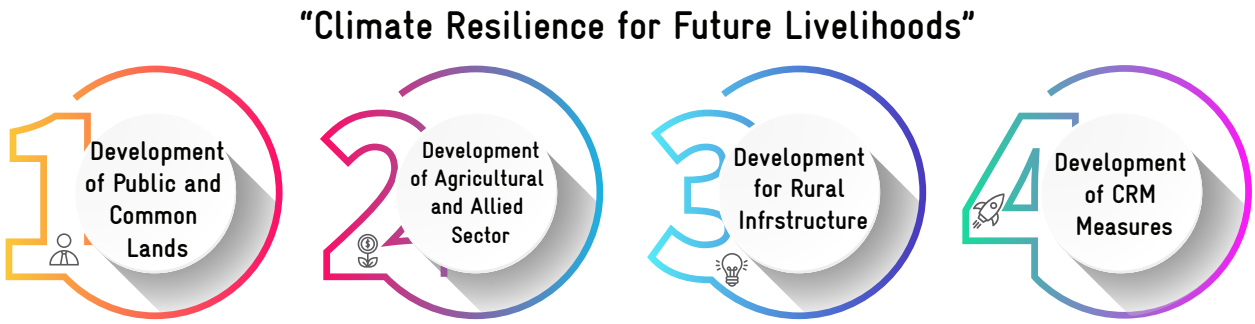
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national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

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 performed in District and Block level vulnerability assessment of WASCA TN also used in SDG India 2020-21 report (Table 21).

TABLE 21. 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 District level vulnerability assessment along with its linked SDGs are already tabulated in (Table 2). The detailed proposed water actions in CWRM assessed based on the vulnerability dimensions are linked with climate vulnerability index, SGDs are tabulated in Table 22 to 24.

TABLE 22. 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 (CCB) for Afforestation area (m)	8,931.4	W3	SDG 1,2, 6,13&15
Composting (No. of units)	684.0	W1	SDG1& 6
Afforestation in Public/common lands (ha)	5,206.0	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	254.0	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	175.0	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	0.1	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	846.0	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	50.3	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	0.2	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	61.9	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies: a.PWD and UnionTanks (count)	105.0	S2, S1	SDG 6, 1, 13
Restoration of waterbodies: b. Ponds (count)	130.0	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	1,126.0	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	50.3	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	865.5	W1,W3,W4	SDG1 & 6

TABLE 23. WATER ACTIONS ON DEVELOPMENT OF AGRICULTURAL AND ALLIED SECTOR & IT'S LINKED SDG

Name of the Work	No. of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	1,288	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation (ha)	168	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	510	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	3,194	W1,W5,A1,A3,S2,S4	SDG 2, 6& 15
Dry land Horticulture/Agro-forestry - Individual (ha)	681	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	1,383	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	1,376	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	204	A3, S4	SDG 1& 2, 15
Cattle Shelters (No. of units)	1,376	S4	SDG 1& 2
Goat Sheep Shelters (No. of units)	419	S4	SDG 1& 2
Cattle Trough (No. of units)	1,376	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	805	S2,S4	SDG 1& 2
Construction of new open wells & Recharge Shafts (No. of units)	1,789	S3,W5,W1	SDG 1,2 & 6

TABLE 24. WATER ACTIONS ON RURAL WATER MANAGEMENT & ITS LINKED SDG

Name of the work	No. of CWRM works	CVI	Linking SDG
Soak Pits (Community) (No. of units)	307	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	1903	W3,S2	SDG 1& 6
Roof Rain Water Harvesting (No. of units)	85	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

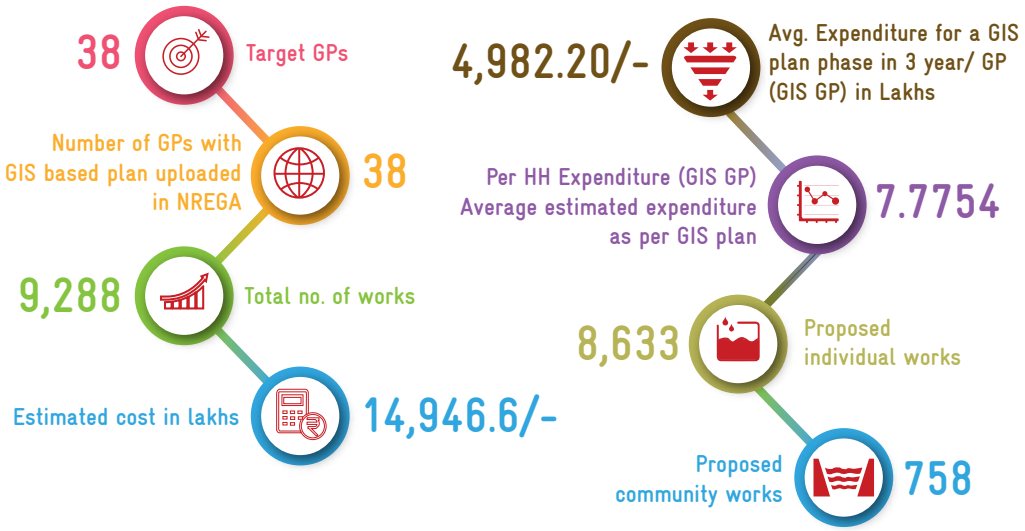
7 IMPLEMENTATION OF GP PLANS

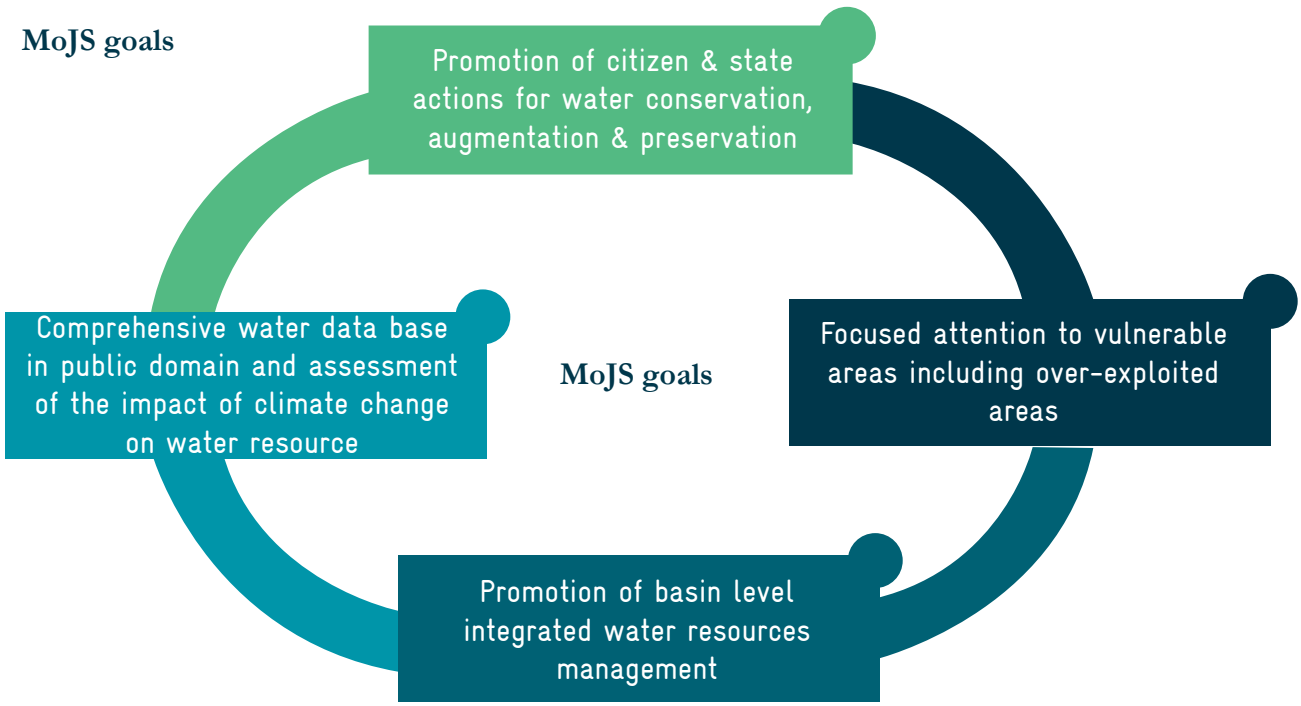
Execution of GP plans includes integrating all verified, approved works in MORD's web enabled application NREGA Soft (https://nrega.nic.in) for mainstreaming WASCA. The target GPs are identified first, the status of GIS based plans and total works along with its expenditure and category wise estimation 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 Arni Block is listed in Table 25 and work progress, expenditure during the past 3 financial years is 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 25. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN ARNI BLOCK





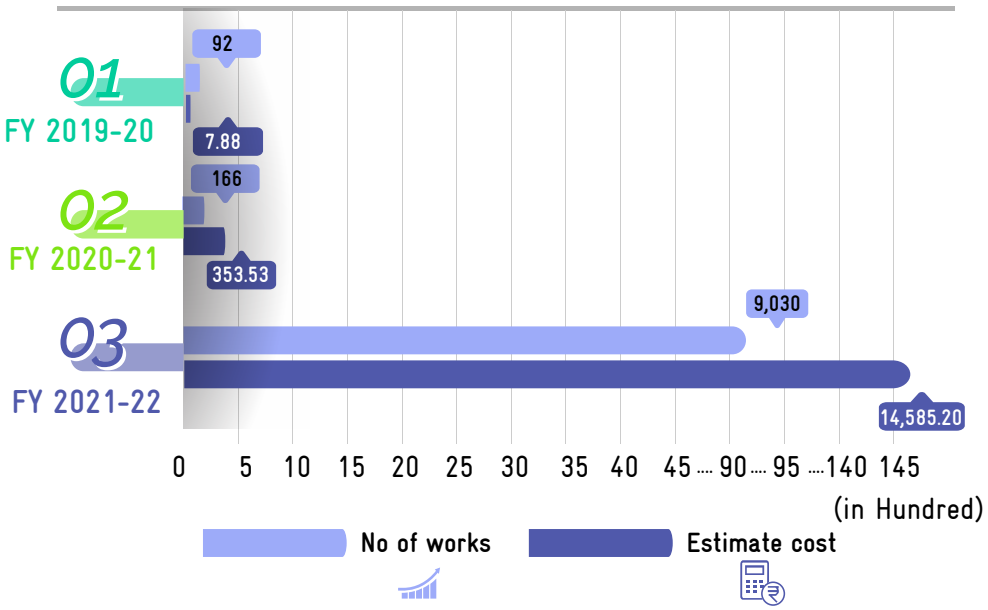


Figure 7.1. Work progress in last 3 years

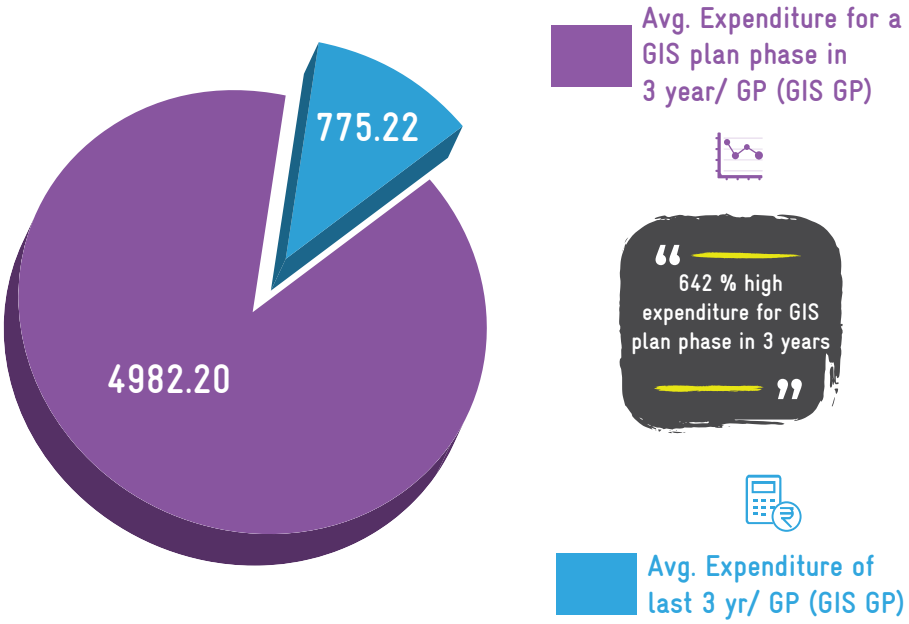
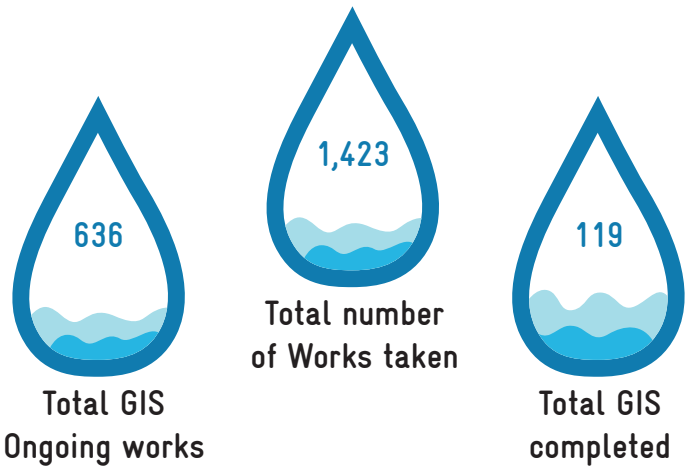


Figure 7.2. Average Expenditure for GIS plan in last 3 years



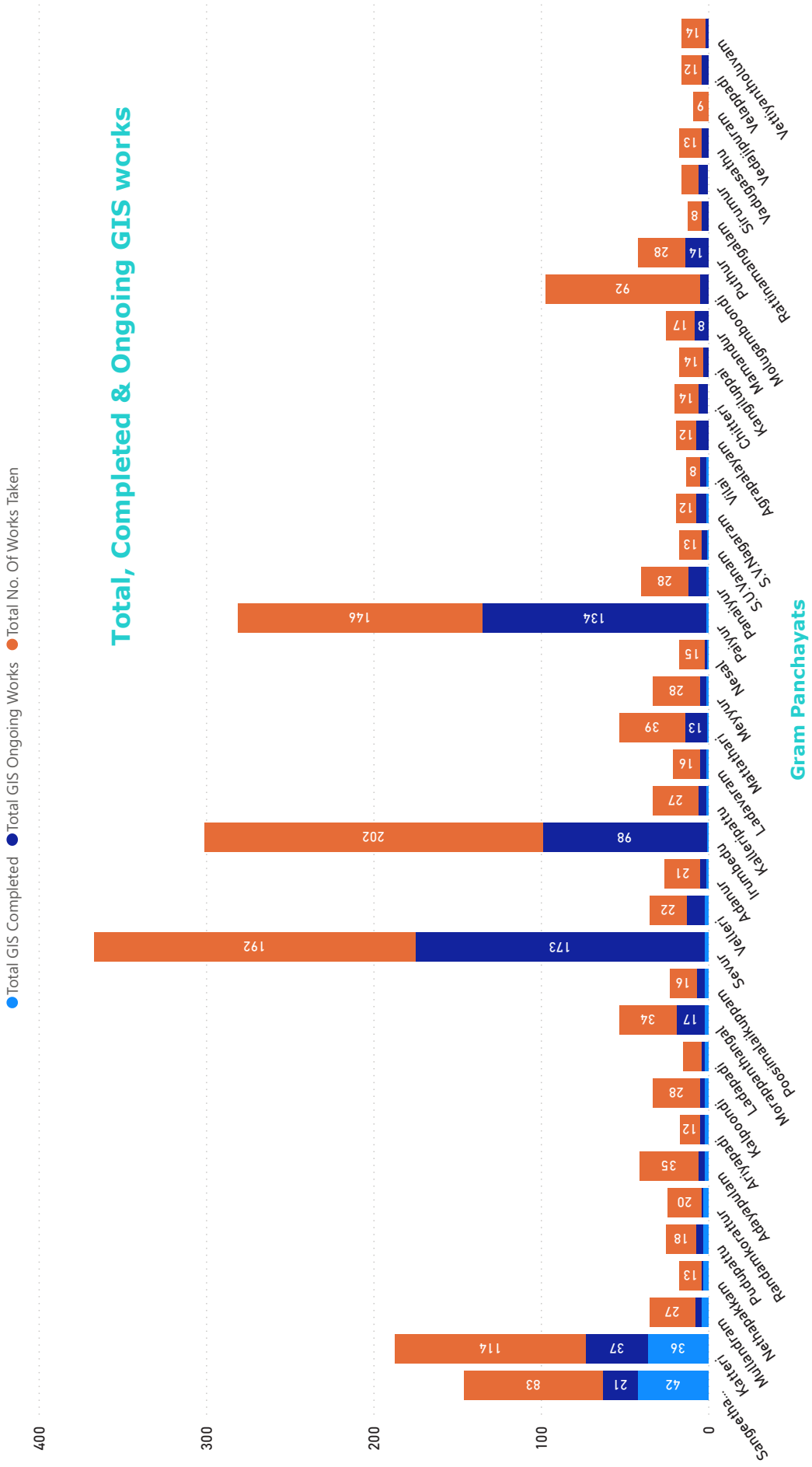
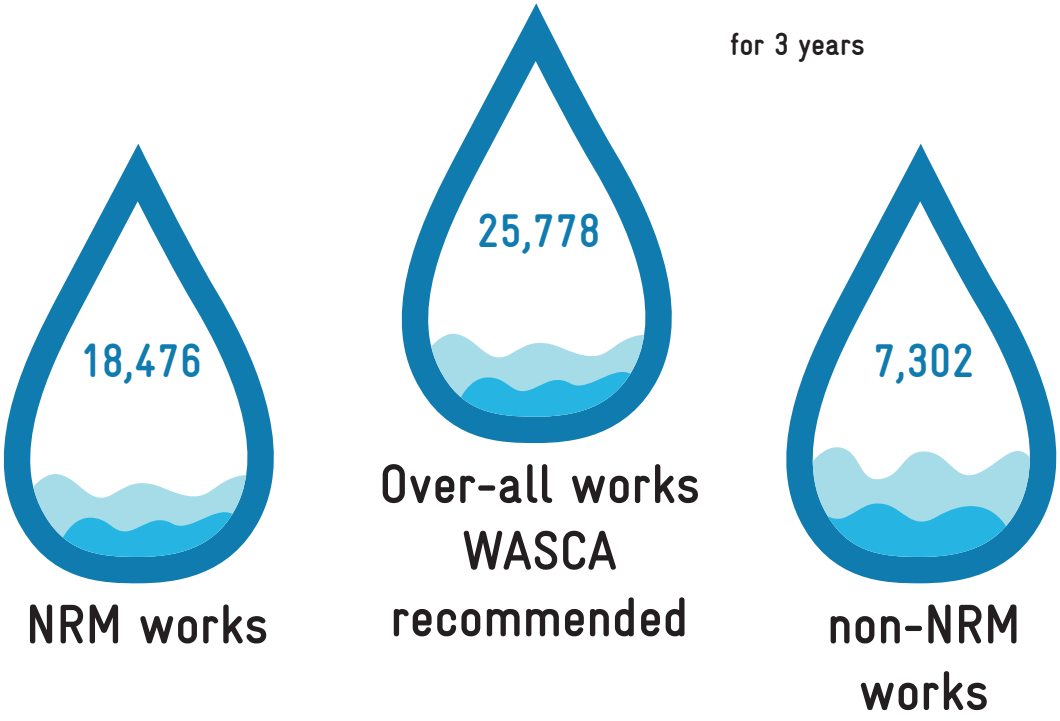


Figure 7.3. GP wise total, completed and ongoing GIS works

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 25,778 works for a period of 3 years, out of which 18,476 are NRM works and 7,302 are non NRM works (Figure 7.4). A total of 17,559 works has been uploaded so far for the financial year 2021-22 as on 07/01/2011.



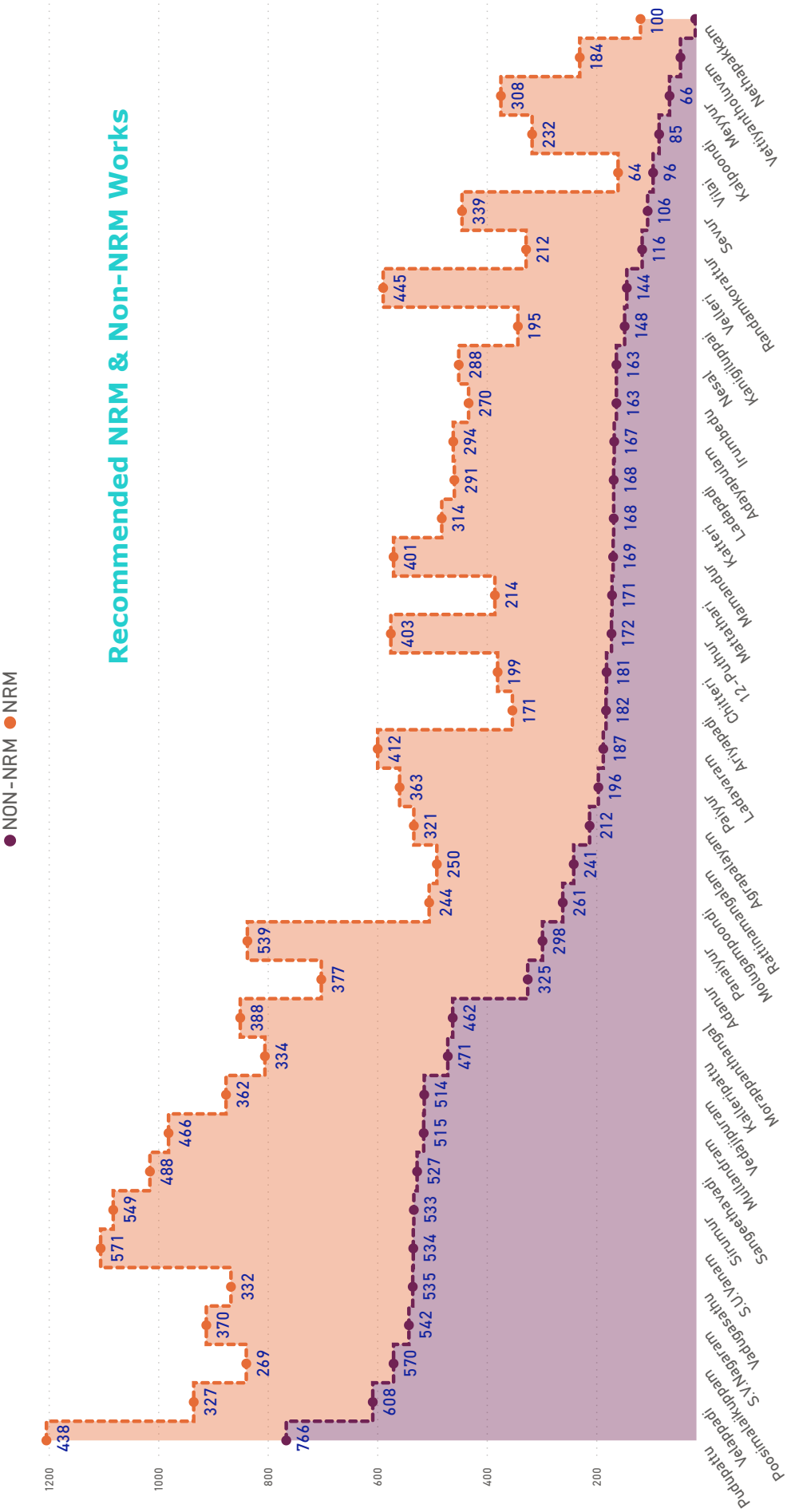


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in Arni Block includes Anganwadi/Other Rural Infrastructure, Drought Proofing, Rural Connectivity, Rural Sanitation, WCWH, Works on Individuals Land (Category IV). A total of 100 works are ongoing in the Block, in which WCWH are more (72 %) followed by individual beneficiary orientated (16 %) while drought proofing, land development and rural connectivity works are less in number (Figure 7.5). GP and work category wise ongoing works are tabulated in Annexure 7.2.

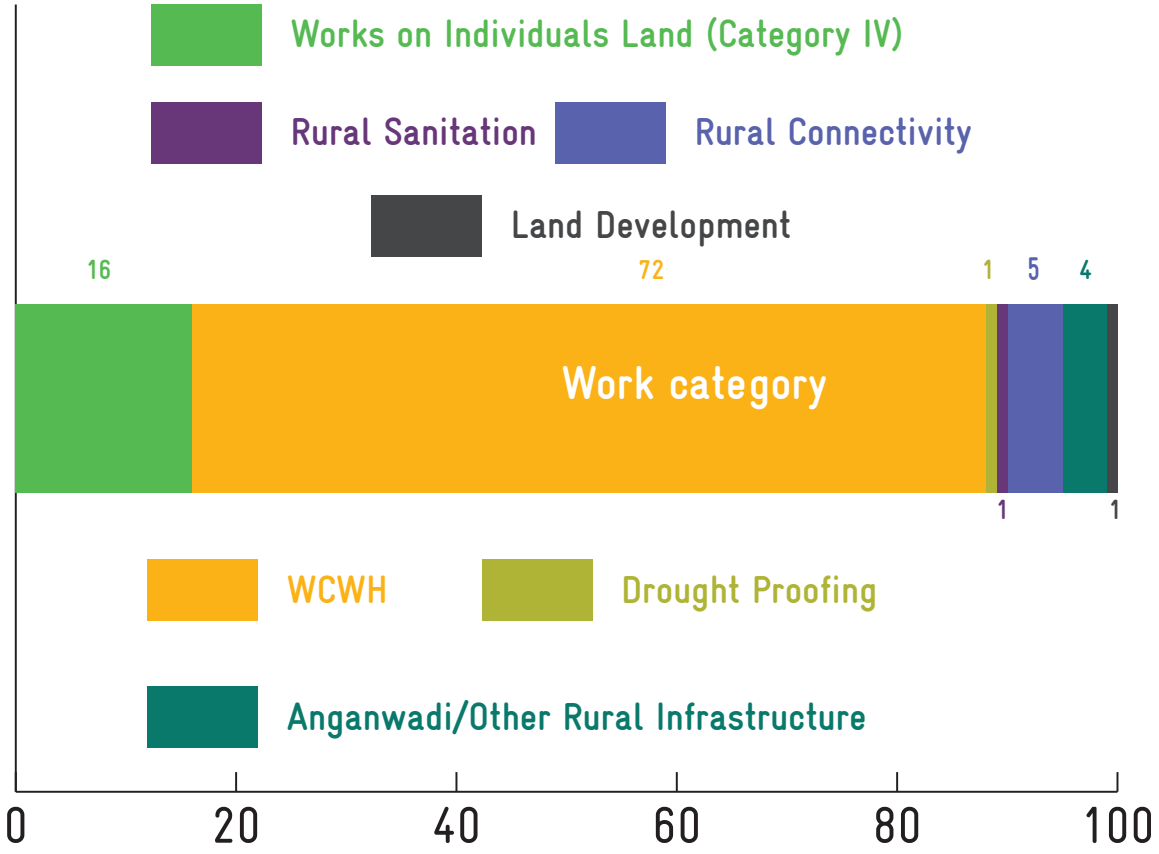


Figure 7.5. Ongoing works in Arni Block

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 sub-soil strata before monsoon season. Under this campaign, drives to make check dams, water harvesting pits, rooftop RWHS, removal of encroachments and de-silting of tanks to increase their storage capacity, removal of obstructions in the channels which bring water to them from the catchment areas, repairs to step-wells and using defunct bore wells and unused wells to put water back to aquifers etc., are to be taken up with the active participation of people. The total expenditure towards progressive works on Catch the Rain campaign of Arni Block is Rs. 3,293.86 Lakhs and nearly 46% of the expenditure utilized for watershed development, 28% for water conservation and rain water harvesting (Figure 7.6).

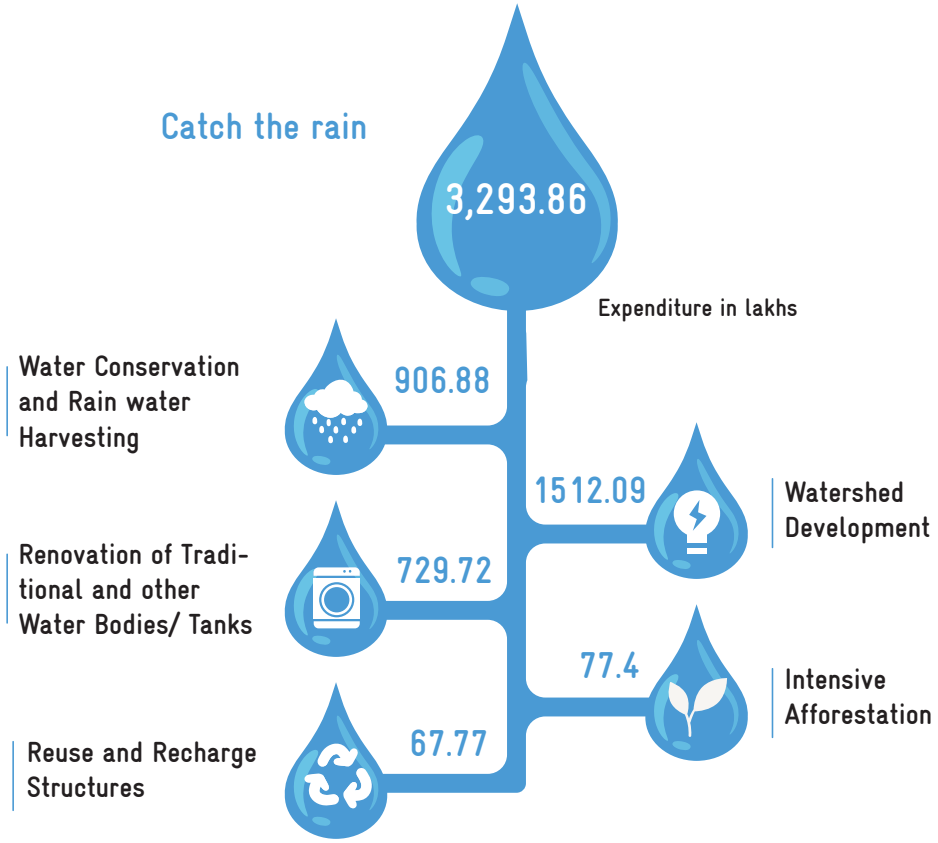
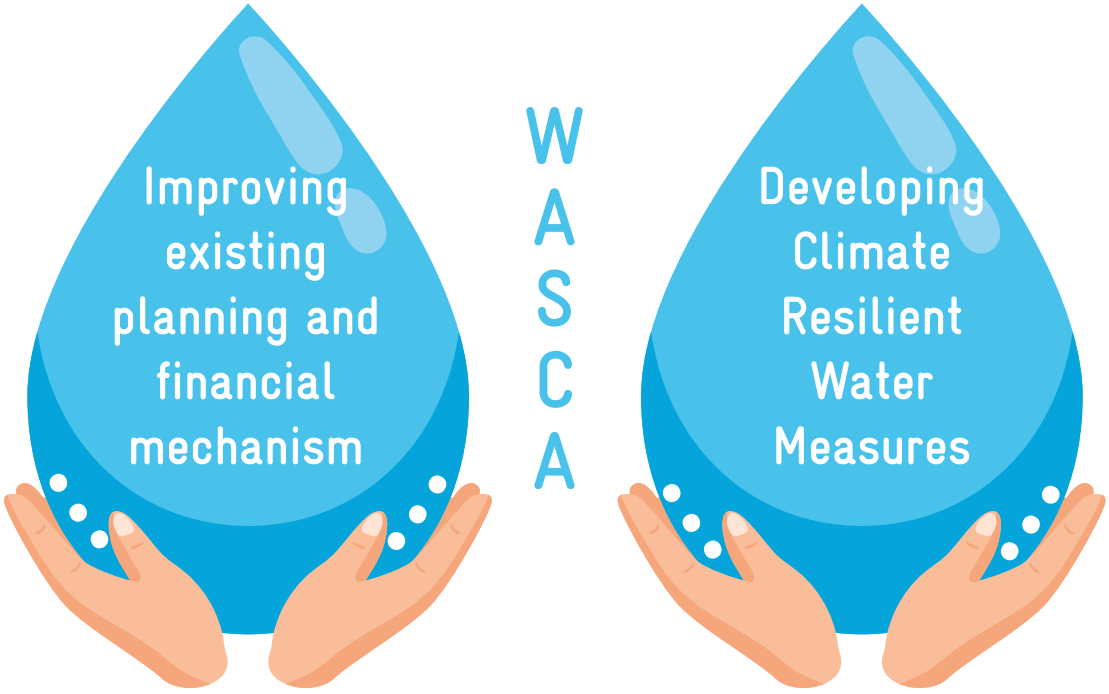


Figure 7.6. Catch the Rain campaign in Arni Block



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 ARNI BLOCK

Arni Block belongs to four sub-basins Cheyyar, Cheyyar River, Naganadi and RB Palar Watersheds (Figure 8.1). Cheyyar watershed (4C2A3) has 17 micro-watersheds covering an area of 10,184.96 ha. Cheyyar River watershed (4C2A4) has 8 micro-watersheds covering an area of 4,982.16 ha. Naganadi watershed (4C2A5) has 35 micro-watersheds covering an area of 16,940.37 ha. RB Palar watershed (4C2A6) has 2 micro-watersheds covering an area of 920.73 ha (Table 26). Out of 38 GPs in the Block, 6 GPs fall under Cheyyar (4C2A3) watershed, 7 GPs fall under Cheyyar River (4C2A4) watershed, 19 GPs fall under Naganadi (4C2A5) watershed, 5 GPs have watershed boundaries passing through Cheyyar and Naganadi. One GP has watershed boundaries passing through Naganadi and RB Palar (Table 27 & Figure 8.2). The micro-watershed-based works are identified using Basin, Sub-basin, and micro Watershed with GP administrative boundaries through Composite Water Resources Management plan approach.

TABLE 26. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING ARNI BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Cheyyar	10,184.96	17
Cheyyar River	4,982.16	8
Naganadi	16,940.37	35
R B Palar	920.73	2

TABLE 27. NO. OF GPs COVERED UNDER WATERSHEDS IN ARNI BLOCK

Name of watershed	No. of GPs
Cheyyar	6
Cheyyar River	7
Naganadi	19
Cheyyar & Naganadi	5
Naganadi & RB Palar	1

Understanding the Block area with respect to its nature of terrain aids in treating the area with appropriate measures at the right place and also ensures efficient management of the watershed (micro or macro). Ridge-based Block area is mapped (zoning) by referring to the spatial thematic datasets and showcased with macro-watershed (Figure 8.3) and GPs boundaries (Figure 8.4). Based on ridge range types such as high, middle, lower and inter variations of the Block area is distinguished into 4 kinds of ridge zones.

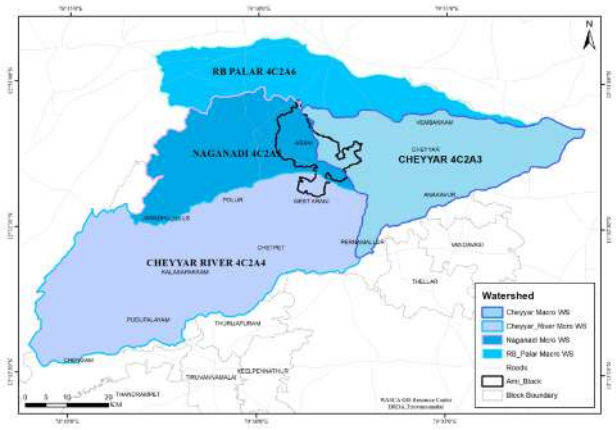


Figure 8.1. Macro-watershed Map of Arni Block

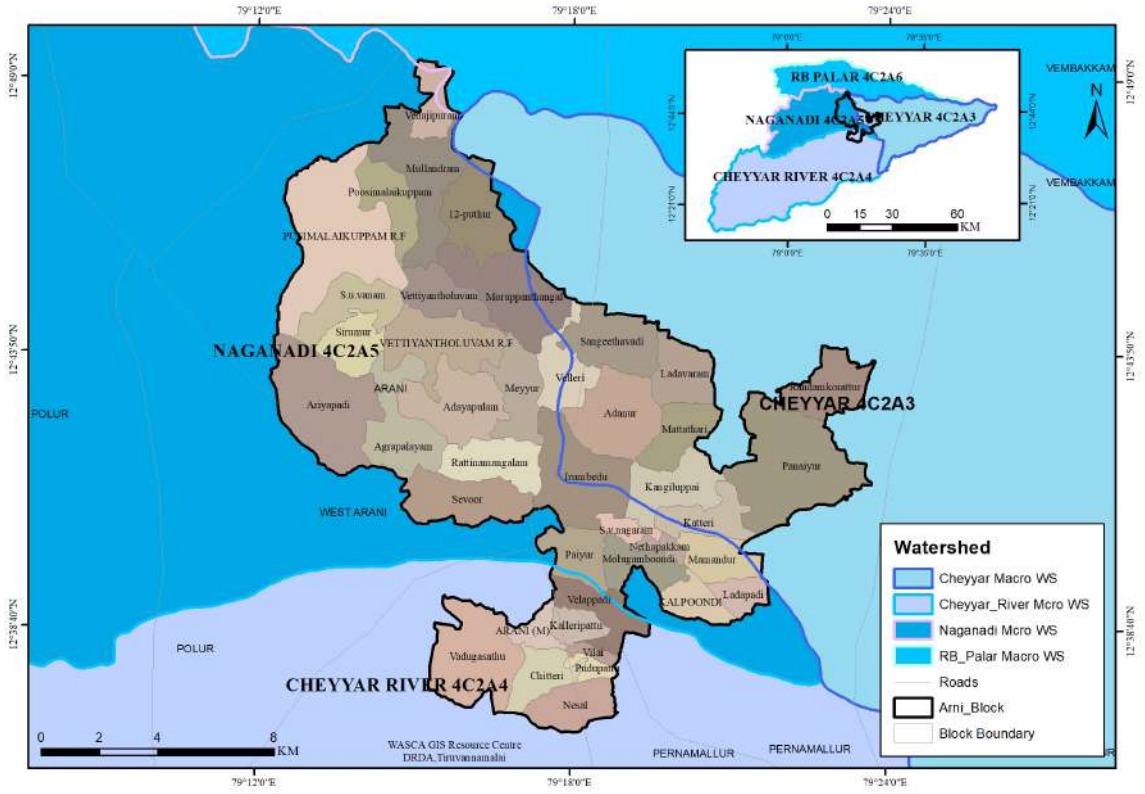


Figure 8.2. Macro-watershed with GPs map

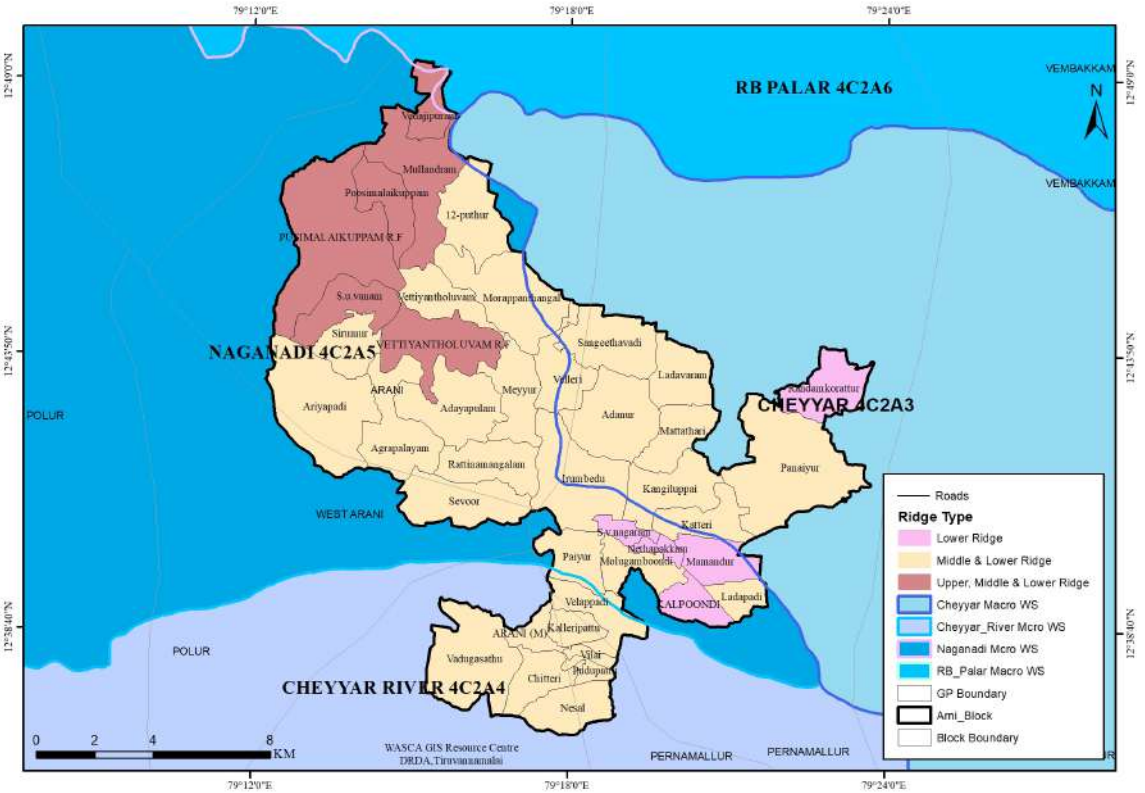


Figure 8.3. Macro-watershed Ridge Map

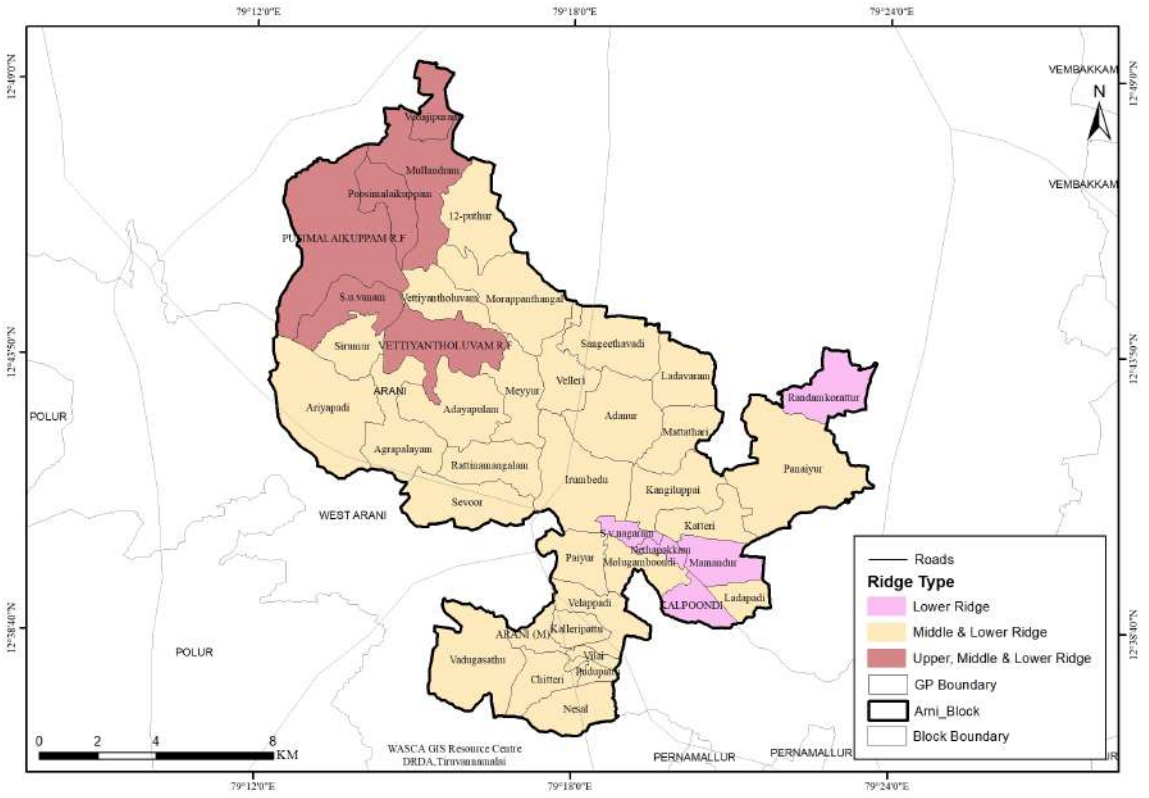


Figure 8.4. GP level Ridge Map

All the proposed works are identified using basin, sub-basin, and micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach. The ridge details, GPs proposed works in all macro watersheds in Thiruvanamali Block are listed in Tables 28 to 41.

TABLE 28. MICRO-WATESHED IN ARNI BLOCK FALLING UNDER CHEYYAR MACRO-WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4C2A3e13c	546.83	Middle & Lower
2	4C2A3e12b	823.36	
3	4C2A3e06b	563.44	
4	4C2A3e05c	497.82	
5	4C2A3e06c	291.26	
6	4C2A3e04a	518.16	
7	4C2A3e05a	1,121.31	
8	4C2A3e05b	247.12	
9	4C2A3e14c	729.38	Lower
10	4C2A3e12a	498.34	
11	4C2A3e07c	629.57	
12	4C2A3e07b	453.89	
13	4C2A3e07a	765.59	
14	4C2A3e04b	591.42	
15	4C2A3e06a	524.12	
16	4C2A3e01c	567.29	
17	4C2A3e01b	816.06	

TABLE 29. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER CHEYYAR MACRO-WATERSHED IN ARNI BLOCK

Sl. No	Name of the GPs	Ridge Type
1	Sangeethavadi	Middle & Lower
2	Mattathari	
3	Adanur	
4	Ladavaram	
5	Panaiyur	
6	Randam Kurattur	Lower

TABLE 30. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER CHEYYAR MACRO-WATERSHED IN ARNI BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	1,125.38
2	Drainage Line Treatment (m)		22,396.28
3	CC Check dams (No.)	Middle	9
4	Block Plantation (Community) (ha)		58.03
5	Avenue plantation (m)		20,386
6	Composting (No.)	Lower	51
7	Canal Bund Plantation (m)		11,244
8	Restoration of water bodies: Tanks and Ooranis (No.)		27
9	Artificial Recharge Structure (No.)		407
10	Farm Bunding with Boundary Trenches - Individual (ha)		69.13
11	Construction of Farm Ponds - Individual (No.)		79
12	Land development - Individual (ha)		1,259
13	Azolla units - Individual (No.)		253
14	NADEP Vermi compost (No.)		253
15	Cattle Shelters (No.)		253
16	Goat Sheep Shelters (No.)		72
17	Cattle Trough (No.)		106
18	Construction of new open wells & Recharge Shafts (No.)		226
19	Soak Pits (Community) (No.)		36
20	Soak Pits (Individual) (No.)		354
21	Roof Rain Water Harvesting (No.)		12
22	Nutri Garden (No.)		1,886
23	Silt application (No.)		503

TABLE 31. MICRO-WATERSHED IN ARNI BLOCK FALLING UNDER CHEYYAR RIVER MACRO-WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4C2A4a14b	893.87	Middle & Lower
2	4C2A4a16a	817.54	
3	4C2A4a14c	425.33	
4	4C2A4a13c	464.40	
5	4C2A4a14a	524.80	
6	4C2A4a13b	815.40	
7	4C2A4a15a	601.71	Lower
8	4C2A4a02c	439.11	

TABLE 32. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER CHEYYAR RIVER MACRO-WATERSHED IN ARNI BLOCK

Sl. No	Name of the GPs	Ridge Type
1	Pudupattu	Middle & Lower
2	Velapadi	
3	Vedugasathu	
4	Chitteri	
5	Kalleripattu	
6	Nesal	
7	Vilai	

TABLE 33. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER CHEYYAR RIVER MACRO-WATERSHED IN ARNI BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	669
2	Drainage Line Treatment (m)		18,394
3	CC Check dams (No.)	Middle	4
4	Block Plantation (Community) (ha)		118.96
5	Silvi-pasture Development (ha)		0.33
6	Avenue plantation (m)		10,738
7	Composting (No.)	Lower	61
8	Canal Bund Plantation (m)		14,320
9	Restoration of water bodies: Tanks and Ooranis (No.)		17
10	Artificial Recharge Structure (No.)		154
11	Farm Bunding with Boundary Trenches - Individual (ha)		502.26
12	Construction of Farm Ponds - Individual (No.)		81
13	Land development - Individual (ha)		188
14	Azolla units - Individual (No.)		327
15	NADEP Vermi compost (No.)		320
16	Cattle Shelters (No.)		320
17	Goat Sheep Shelters (No.)		59
18	Cattle Trough (No.)		320
19	Construction of new open wells & Recharge Shafts (No.)		70
20	Soak Pits (Community) (No.)		45

21	Soak Pits (Individual) (No.)	Lower	525
22	Roof Rain Water Harvesting (No.)		12
23	Nutri Garden (No.)		2,978
24	Silt application (No.)		79

TABLE 34. MICRO-WATERSHED IN ARNI BLOCK FALLING UNDER NAGANADI MACRO-WATERSHED

Sl. No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4C2A5a12a	610.86	Upper, Middle & Lower
2	4C2A5a11a	425.32	
3	4C2A5a11b	669.61	
4	4C2A5a09c	457.66	
5	4C2A5a07c	599.20	
6	4C2A5a10c	263.48	
7	4C2A5a10b	555.94	
8	4C2A5a10a	669.49	
9	4C2A5b04c	431.27	
10	4C2A5b04b	339.01	
11	4C2A5a08c	387.94	
12	4C2A5b04a	470.52	
13	4C2A5a08b	419.35	
14	4C2A5a09b	518.20	Middle & Lower
15	4C2A5a07b	417.96	
16	4C2A5a09a	310.91	
17	4C2A5a07a	612.70	
18	4C2A5a03c	350.75	
19	4C2A5a08a	568.19	
20	4C2A5a05b	480.97	
21	4C2A5a03b	476.01	
22	4C2A5b01c	490.08	
23	4C2A5a05a	677.96	
24	4C2A5a04a	413.06	
25	4C2A5a04b	655.84	
26	4C2A5a02d	214.71	
27	4C2A5a03a	195.44	
28	4C2A5a02a	510.65	
29	4C2A5a06a	794.48	
30	4C2A5a02c	438.54	
31	4C2A5a02b	661.89	
32	4C2A5a01c	506.54	
33	4C2A5a01a	398.30	
34	4C2A5a01b	444.81	
35	4C2A5a12b	502.70	Lower

TABLE 35. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER NAGANADI MACRO-WATERSHED IN ARNI BLOCK

Sl. No	Name of GPs	Ridge Type
1	Poosimalaikuppam	Upper, Middle & Lower
2	Mullandram	
3	Su Vanam	
4	Ladapadi	Middle & Lower
5	Muzhugampoondi	
6	Paiyur	
7	Vettiyantholuvam	
8	Rattinamanagalam	
9	Agarapalayam	
10	Adaiyapulam	
11	Sirumur	
12	Ariyapadi	
13	12 Puthur	
14	Sevur	
15	Meyyur	
16	Mamandur	Lower
17	Nethapakkam	
18	S V Nagaram	
19	Kalpoondi	

TABLE 36. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER NAGANADI MACRO-WATERSHED IN ARNI BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	3,238.25
2	Drainage Line Treatment (m)		37,068.47
3	CC Check dams (No.)	Middle	17
4	Block Plantation (Community) (ha)		291.96
5	Avenue plantation (m)		47,429
6	Composting (No.)	Lower	126
7	Canal Bund Plantation (m)		29,658
8	Restoration of water bodies: Tanks and Ooranis (No.)		79
9	Artificial Recharge Structure (No.)		1077
10	Farm Bunding with Boundary Trenches - Individual (ha)		636.95
11	Construction of Farm Ponds - Individual (No.)		233
12	Land development - Individual (ha)		1,338.54
13	Azolla units - Individual (No.)		584
14	NADEP Vermi compost (No.)		584
15	Cattle Shelters (No.)		584
16	Goat Sheep Shelters (No.)		212
17	Cattle Trough (No.)		584
18	Construction of new open wells & Recharge Shafts (No.)		483
19	Soak Pits (Community) (No.)		127
20	Soak Pits (Individual) (No.)		1,522

21	Roof Rain Water Harvesting (No.)	Lower	36
22	Nutri Garden (No.)		9,639
23	Silt application (No.)		541

TABLE 37. MICRO-WATERSHED IN ARNI BLOCK FALLING UNDER RB PALAR MACRO-WATERSHED

Sl.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4C2A6b14a	415.35	Upper, Middle & Lower
2	4C2A6b13c	505.38	

TABLE 38. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER CHEYYAR & NAGANADI MACRO-WATERSHED IN ARNI BLOCK

Sl. No	Name of GP	Ridge Type
1	Morrappanthangal	Middle & Lower
2	Irumbedu	
3	Katteri	
4	Kanikilippai	
5	Velleri	

TABLE 39. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER CHEYYAR & NAGANADI MACRO-WATERSHED IN ARNI BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	933.96
2	Drainage Line Treatment (m)		9,000
3	CC Check dams (No.)	Middle	7
4	Block Plantation (Community) (ha)		290.11
5	Avenue plantation (m)		24,010
6	Composting (No.)	Lower	35
7	Canal Bund Plantation (m)		7,105
8	Restoration of water bodies: Tanks and Ooranis (No.)		27
9	Artificial Recharge Structure (No.)		268
10	Farm Bunding with Boundary Trenches - Individual (ha)		38.91
11	Construction of Farm Ponds - Individual (No.)		94
12	Land development - Individual (ha)		240.04
13	Azolla units - Individual (No.)		182
14	NADEP Vermi compost (No.)		182
15	Cattle Shelters (No.)		182
16	Goat Sheep Shelters (No.)		69
17	Cattle Trough (No.)		182
18	Construction of new open wells & Recharge Shafts (No.)		74
19	Soak Pits (Community) (No.)		35
20	Soak Pits (Individual) (No.)		378
21	Roof Rain Water Harvesting (No.)		10
22	Nutri Garden (No.)		2,074
23	Silt application (No.)		103

TABLE 40. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER NAGANADI & RB PALAR MACRO-WATERSHED IN ARNI BLOCK

Name of GP	Ridge Type
Vedajipuram	Upper, Middle & Lower

TABLE 41. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER NAGANADI & RB PALAR MACRO-WATERSHED IN ARNI BLOCK

Sl.No	Proposed Work	Ridge Type	Extent
1	Afforestation in Public/common lands (ha)	Upper	418
2	Drainage Line Treatment (m)		3,200
3	CC Check dams (No.)	Middle	1
4	Block Plantation (Community) (ha)		4
5	Avenue plantation (m)		2,737
6	Composting (No.)	Lower	6
7	Canal Bund Plantation (m)		3,200
8	Restoration of water bodies: Tanks and Ooranis (No.)		1
9	Artificial Recharge Structure (No.)		56
10	Farm Bunding with Boundary Trenches - Individual (ha)		21
11	Construction of Farm Ponds - Individual (No.)		10
12	Land development - Individual (ha)		10
13	Azolla units - Individual (No.)		24
14	NADEP Vermi compost (No.)		24
15	Cattle Shelters (No.)		24
16	Goat Sheep Shelters (No.)		4
17	Cattle Trough (No.)		24
18	Soak Pits (Community) (No.)		3
19	Soak Pits (Individual) (No.)		31
20	Roof Rain Water Harvesting (No.)		2
21	Nutri Garden (No.)		309
22	Silt application (No.)		4

8.2 MODEL MICRO-WATERSHED - POOSIMALAIKUPPAM

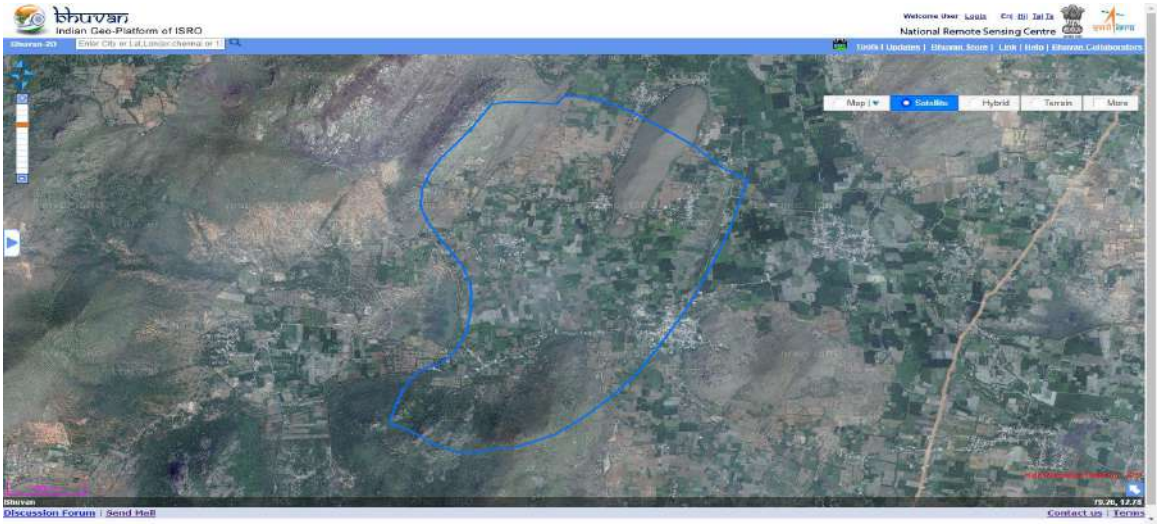


Figure 8.5. Satellite image of Poosimalaikuppam micro-watershed

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

POOSIMALAIKUPPAMM MICRO-WATERSHED

Poosimalaikuppam micro-watershed falls under Poosimalaikuppam and Mullandram GPs, Arni Block in Thiruvannamalai District (Figure 8.5). This micro-watershed is a part of Naganadhi macro-watershed in Cheyyar sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of Poosimalaikuppam micro-watershed is given below in separate sections followed by proposed works (Figure 8.7 and 8.8), ridge wise proposed treatment area, estimated cost and required person days and key outcomes (Table 42 to 53). The key CWRM parameters for the GPs falling (Figure 8.6) in this micro-watershed is Annexed 8.

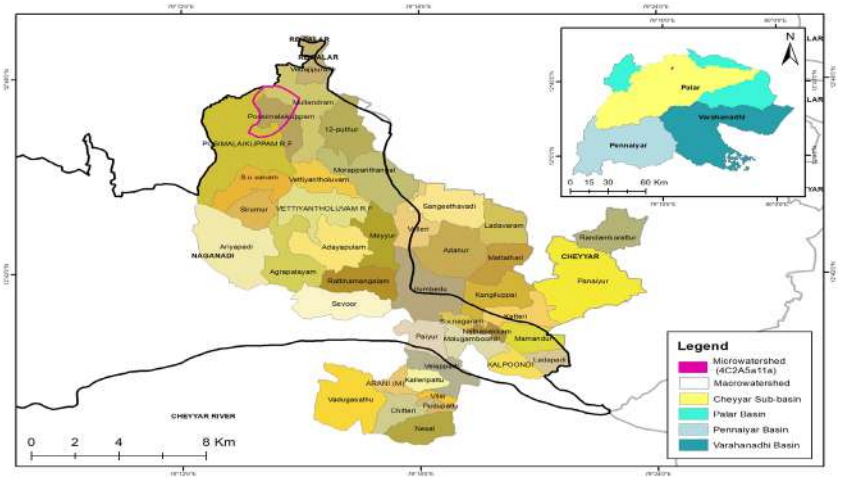


Figure 8.6. Poosimalaikuppam micro-watershed with GPs

TABLE 42. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the micro-watershed	**Poosimalaikuppam**
Micro -watershed Number	**4C2A5a11a**
Name of the Basin	Palar Basin
Name of the sub-basin	Cheyyar Sub Basin
Name of the macro-watershed	Naganadhi
Number of GPs covered under the micro-watershed	2
Number of Reserved Forest covered under the micro- watershed	1
Name of the GPs	1. Poosimalaikuppam
	2. Mullandram
Name of the Reserved Forest	Poosimalaikuppam R.F
Latitude of micro-watershed (From To)	12°46'12.97"N to 12°47'46.20"N
Longitude of micro-watershed (From To)	79°13'41.66"E to 79°14'58.16"E
Total area of the micro-watershed in ha	424
% of micro-watershed area in Poosimalaikuppam GP	52
% of micro-watershed area in Mullandram GP	26
% of micro-watershed area in Poosimalaikuppam R.F	22
Area of micro-watershed falling in Poosimalaikuppam GP (ha)	219
Area of micro-watershed falling in Mullandram GP (ha)	112
Area of micro-watershed falling in Poosimalaikuppam R.F (ha)	93
Total Population of Poosimalaikuppam GP	2,486
Total Population of Mullandram GP	4,202
Annual Average Rainfall (mm)	1,047
Annual maximum Temperature (◦C)	33
Annual Minimum Temperature (◦C)	22.8
Evapo-Transporation Losses of Poosimalaikuppam GP (ha.m)	9.37
Evapo-Transporation Losses of Mullandram GP (ha.m)	22.75
Volumetric soil moisture availability (%)	23
Climate Risk	Drought and heat waves
CVI Index Value for Poosimalaikuppam GP (Based on WASCA Climate study)	0.54
CVI Index Value for Mullandram GP (Based on WASCA Climate study)	0.521
Agro-Climatic Zone	North eastern zone (TN-1)
Agro Ecological Sub-Region (ICAR)	Eastern Ghats
Status of Ground water in Poosimalaikuppam GP	Over Exploited
Status of Ground water in Mullandramr GP	Over Exploited

TABLE 43. GEOLOGY, HYDROGEOLOGY OTHER CHARACTERISTICS IN MICRO-WATERSHED

Geology occurrence in % (Hard rock)	100
Geology Quality	Moderate
Depth of weathered zone and/or maximum depth of fractures in Hard Rock area (in m)	30 to 60
Bottom of the unconfined aquifer in soft rock areas (in m)	20 to 40
No of lineaments passing through the micro-watershed	3

Type of lineaments passing through the micro-watershed	One is Geomorphic lineaments, ridge parallel, and other two lineaments are Structural Lineaments, Joint/Fracture
Sheet Erosion	84 ha (upper and middel ridge)
Barren & waste lands	41 ha Scrub Land (upper and middel ridge)

TABLE 44. NATURAL DRAINAGE LINES & HILLOCKS IN POOSIMALAIKUPPAM MICRO-WATERSHED

No. of 1st Order drains	1
Total length of natural drainage line (m)	1,935
Drainage density (ha.m)	4.56
No. of Hillocks/hills surrounding the Micro-watershed	1 Nos
Type of Hillocks / hills	Highly degraded

TABLE 45. MICRO-WATERSHED'S CATCHMENT AREA

Catchment Area in ha	Poosimalaikuppam GP	Mullandram GP
Good catchment area	176.44	782.26
Average catchment area	0	0
Bad catchment area	260.84	354.18

TABLE 46. GROUND WATER STATUS OF MICRO-WATERSHED

Firka Assessment Unit for Poosimalaikuppam and Mullandram GP in ha.m	
Name of the Firka (Assesment Unit) falling under Micro-watershed	Agrapalayam
Net Annual Ground Water Availability	2,159.18
Existing Gross Ground Water Draft for Irrigation	1,756.80
Existing Gross Ground Water Draft for domestic and industrial water supply	72.71
Existing Gross Ground Water Draft for All uses	1,829.51
Provision for domestic and industrial requirement supply to 2025	82.64
Net Ground Water Availability for future irrigation development	319.74

TABLE 47. GP WISE WATER BUDGET OF MICRO-WATERSHED- POOSIMALAIKUPPAM & MULLANDRAM

Water Budget in ha.m	Poosimalaikuppam GP	Mullandram GP
Water for Human	6.81	11.5
Water for Agriculture	174.2	415.7
Water for Animal	2.63	3.77
Village wise water required	183.7	430.9

Available run-off from rain water (derived from Strange method)	114.9	359.6
Harvested Runoff from Water Harvesting Activities	5.1	7.7
Potential Harvesting from proposed Interventions	34.9	19.1
Total Water harvested	40	26.8
Water demand and Supply Difference	-143.7	-404.2
Water Demand Supply Gap Status	Deficient	Deficient
Per capita Water Availability in cum	462.18	855.78
International Standard per capita water Availability in cum	1,700	1,700
Water Availability Gap	-1,237.81	-844.21
Water security status	Water Stress	Water Stress

TABLE 48. GP WISE PROPOSED MICRO-WATERSHED WORKS – POOSIMALAIKUPPAM AND MULLANDRAM

Ridge type	Poosimalaikuppam GP	Mullandram GP
Upper	-	2
Middle	8	5
Lower	134	68
Total	142	75

TABLE 49. RIDGE WISE TREATMENT AREA, ESTIMATED COST AND PERSON DAYS REQUIRED - POOSIMALAIKUPPAM AND MULLANDRAM

	Poosimalaikuppam GP	Mullandram GP
Upper Ridge		
Estimated cost for Upper Ridge area (INR in Lakhs)	No Upper Ridge falling in the GP	178.29
Total area in ha of Upper Ridge		18
Treatment cost of Upper Ridge Lakhs per ha		**9.8**
Estimated Persondays generated for Treatment of Upper Ridge		**64,534**
Middle Ridge		
Estimated cost for Middle Ridge area (INR in Lakhs)	33	117
Total area in ha of Middle Ridge	18	16
Treatment cost of Middle Ridge Lakhs per ha	**1.83**	**7.31**
Estimated Person days generated for Treatment of Middle Ridge	**12,893**	**14,114**
Lower Ridge		
Estimated cost for Lower Ridge area (INR in Lakhs)	191.53	83
Total area in ha of Lower Ridge	201	78
Treatment cost of Lower Ridge (INR in Lakhs per ha)	**0.95**	**1.06**
Estimated Person days generated for Treatment of Lower Ridge	**69,118**	**35,478**

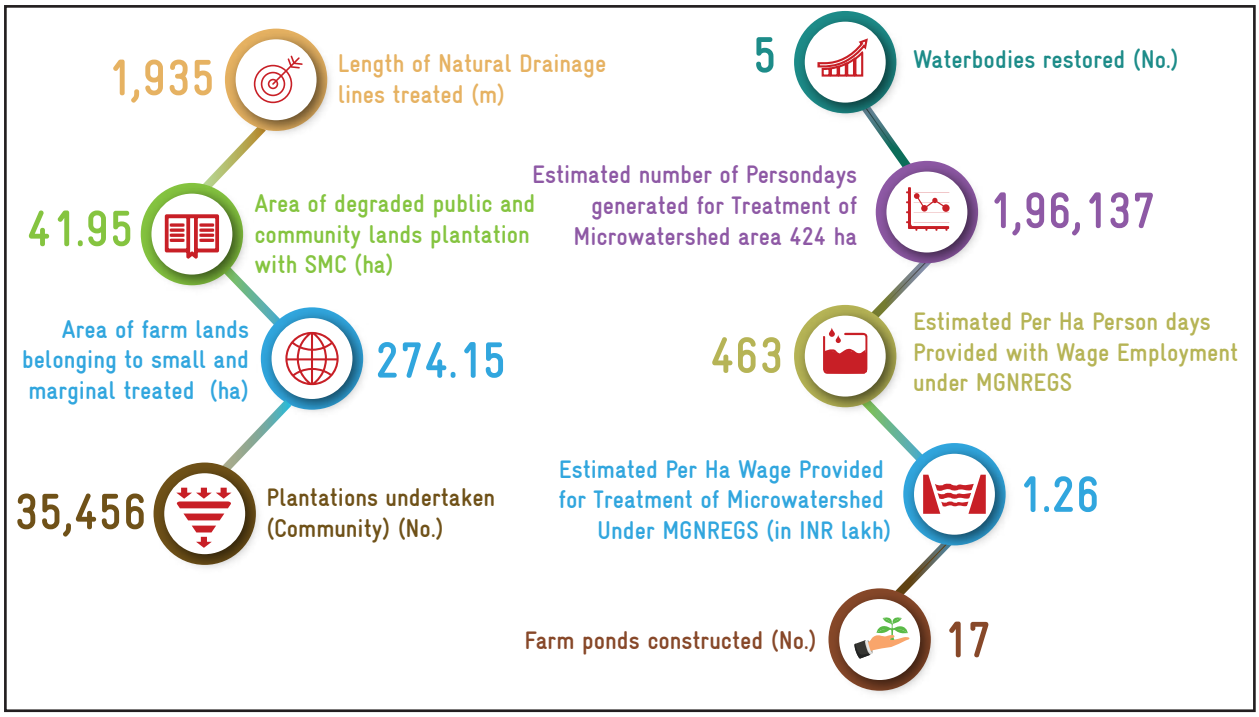
Poosimalaikuppam GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	NA	NA
Middle Ridge	1.83 lakh/ha	12,893
Lower Ridge	0.95 lakh/ha	69,118
	2.78 lakh/ha	82,011

Mullandram GP	Treatment cost (INR in lakhs)	Estimated person days
Upper Ridge	9.8 lakh/ha	64,534
Middle Ridge	7.31 lakh/ha	14,114
Lower Ridge	1.06 lakh/ha	35,478
	18.17 lakh/ha	1,14,126

TABLE 50. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	127
Total No. of works in Micro-watershed including livelihood Activities	44
Total No. of works in Micro-watershed including Rural Greywater Management Activities	46

TABLE 51. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Poosimalaikuppam GP	54.66 lakh
Mullandram GP	98.7 lakh

TABLE 52. ESTIMATES OF MICRO-WATERSHED IN POOSIMALAIKUPPAM 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						
Loose boulder check dam (No.)	Lower	Not commenced	1	1	0.85	42
Compost Pit (No.)			6	6	1.02	90
Sunken Pit in 1st order (No.)		Ongoing	1	1	1.54	383
Block plantation (ha)		Commenced	4.6	1	44.4	17,280
Restoration of Traditional water bodies: (Pond) (No.)			4	4	4	800
Avenue plantation (km)			4.7	3	8.46	3,304
Sub total				**16**	**60.27**	**21,899**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Farm Bunding with Boundary Trenches - Individual (ha & No.)	Middle	Not commenced	10	5	7.5	2,930
			5			
Dryland Horticulture (ha & No,)			8	3	25.5	9,963
			3			
Artificial Recharge Structure for borewell farmers (No.)	Lower		16	16	40	6,256
Silt application (No,)			3	3		
Fodder development - Individual (No.)			10	10	14.8	23,440
Construction of Farm Ponds - Individual (No.)		Ongoing	12	12	24	9,372
Azolla Production units - Individual (No.)		Commenced	10	10	1.5	230
NADEP Vermi compost (No.)			10	10	1.8	270
Sub total				**69**	**115.1**	**52,461**
Total				**85**	**175.37**	**74,360**
Livelihood enhancement activities for Individual Farmers (dryland)						
Cattle Shelters (No.)	Lower	Commenced	11	11	23.32	3,641
Goat Sheep Shelters (No.)			7	7	15.89	2,485
Cattle Trough (No.)		Not commenced	11	11	0.55	66
Sub total				**29**	**39.76**	**6,192**
Rooftop Rainwater and Rural Greywater Management						
Rainwater harvesting Structures (No.)	Lower	Not commenced	2	2	8	1,250
Soak Pits (Individual) (No.)		Ongoing	13	13	1.3	208
Nutri Garden (No.)		Not commenced	13	13	0.1	1
Sub total				**28**	**9.4**	**1,459**
Total				**142**	**224.53**	**82,011**

TOTAL ESTIMATES OF MICRO-WATERSHED IN POOSIMALAIKUPPAM GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Poosimalaikuppam GP	142	224.53	82,011

TABLE 53. ESTIMATES OF MICRO-WATERSHED IN MULLANDRAM GP

Proposed Work	RidgeType	Status of Work	Extent	No. of works as per KML	Estimate cost (in Lakhs)	Person days
NRM works in Public and Community Lands						
Avenue plantation (km)	Lower	Commenced	0.62	1	1.08	421
Restoration of Tradational water bodies: (Union Tank) (No.)			1	1	5	800
Afforestation (ha)		Not commenced	3.35	1	28	11,202
Tank bund Plantation (No.)			1	1	1.8	703
Compost Pit (No.)			3	3	0.51	45
Water Absorption Trench (m)	Middle		1,000	1	97	6,300
Staggered Trench (No.)	Upper & Middle	Completed	27,200	1	28.4	11,034
Greening of Hillocks Plantation and Maintenance (No.)			27,800	1	149.7	53,500
Sub total				**10**	**311.57**	**84,005**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Azolla Production units - Individual (No.)	Lower	Commenced	7	7	1.05	161
NADEP Vermi compost (No.)			6	6	1.08	162
Artificial Recharge Structure for borewell farmers (No.)		Not commenced	2	2	5	782
Fodder development - Individual (No.)			6	6	8.88	14,064
Silt application (No.)			2	2		
Construction of Farm Ponds - Individual (No.)		Ongoing	5	5	10	3,905
Dryland Horticulture (ha & No.)	Middle	Not commenced	5	2	17	6,642
			2			
Farm Bunding with Boundary Trenches - Individual (ha & No.)			5	2	3	1,172
Sub total				**32**	**46.01**	**26,888**

Livelihood enhancement activities for Individual Farmers (dryland)						
Cattle Shelters (No.)	Lower	Commenced	6	6	12.72	1,986
Goat Sheep Shelters (No.)			3	3	6.81	1,065
Cattle Trough (No.)		Not commenced	6	6	0.3	36
Sub total				**15**	**19.83**	**3,087**
Rural Greywater Management						
Soak Pits (Individual) (No.)	Lower	Commenced	9	9	0.9	144
Nutri Garden (No.)		Not commenced	9	9	0.01	2
Sub total				**18**	**0.91**	**146**
Total				**75**	**378.32**	**1,14,126**

TOTAL ESTIMATES OF MICRO-WATERSHED IN MULLANDRAM GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Mullandram GP	75	378.32	1,14,126

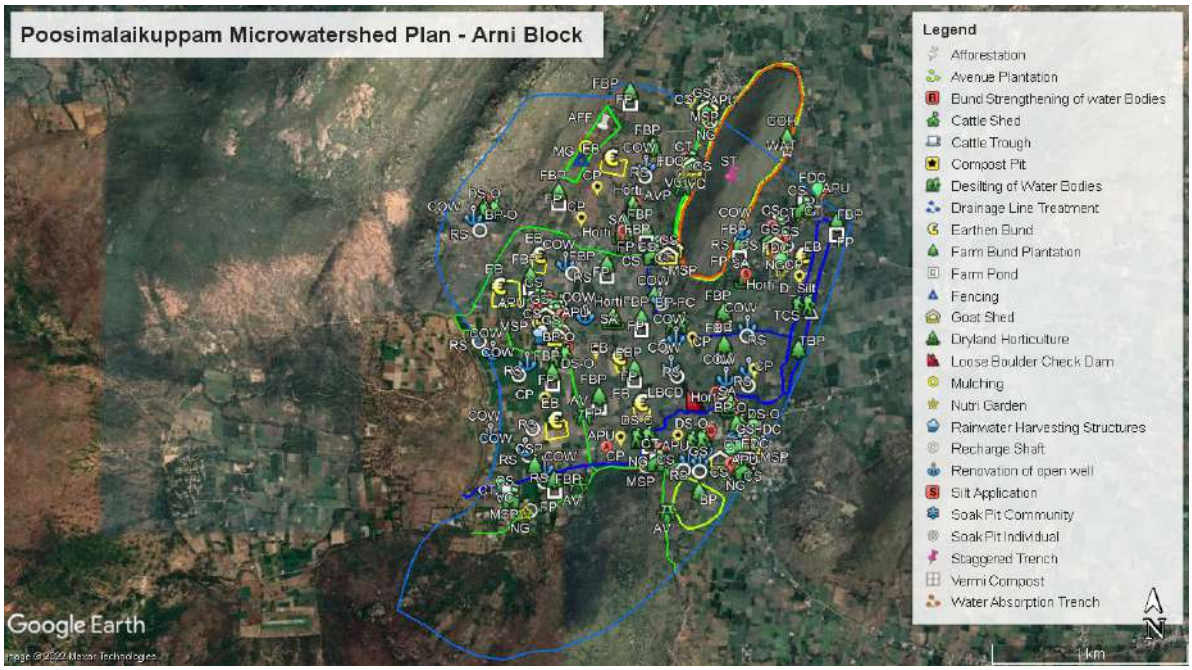
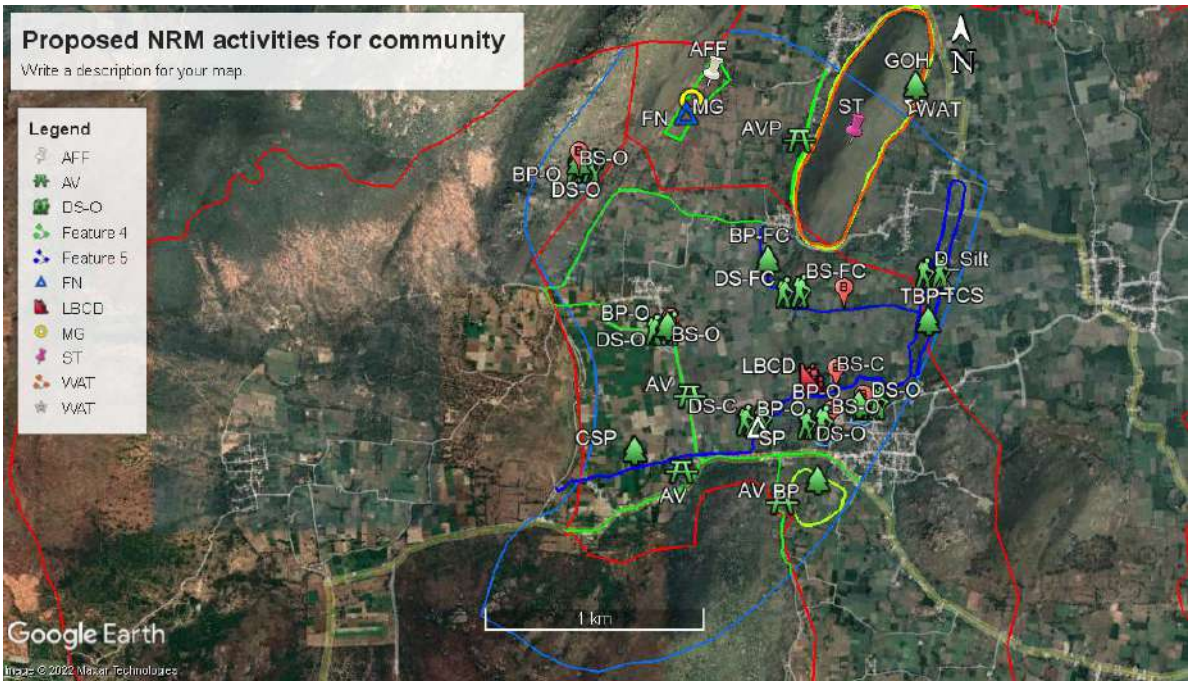


Figure 8.7. Proposed activities in Poosimalaikuppam micro-watershed


Proposed NRM activities for community
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AVP
BS-O
BP-O
DS-O
BP-FC
DS-FC
BS-FC
D_Silt
TBP-FCS
BP-O
DS-O
BS-O
LBCD
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Proposed Non-NRM activities for community
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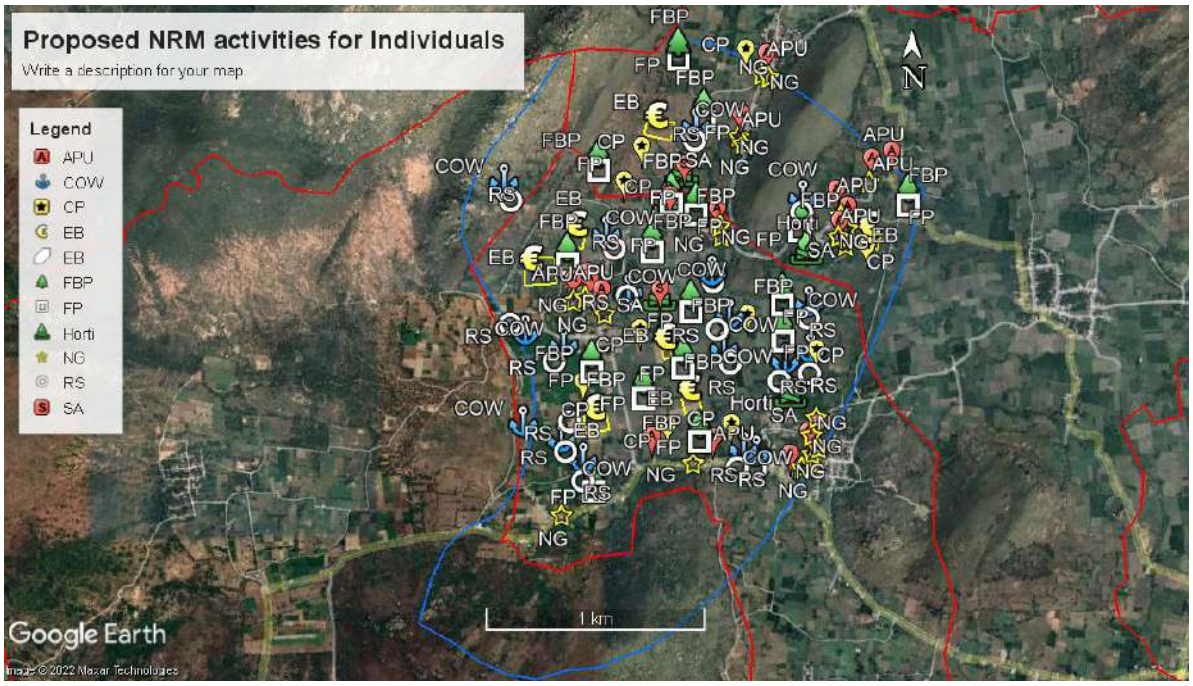


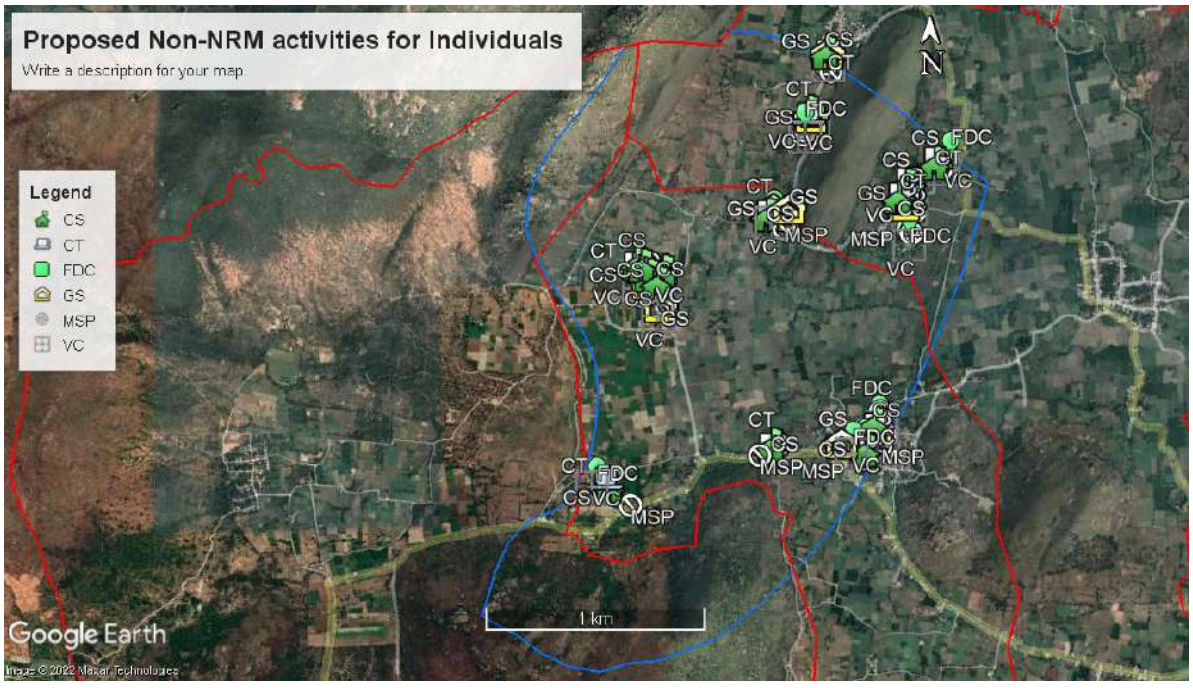
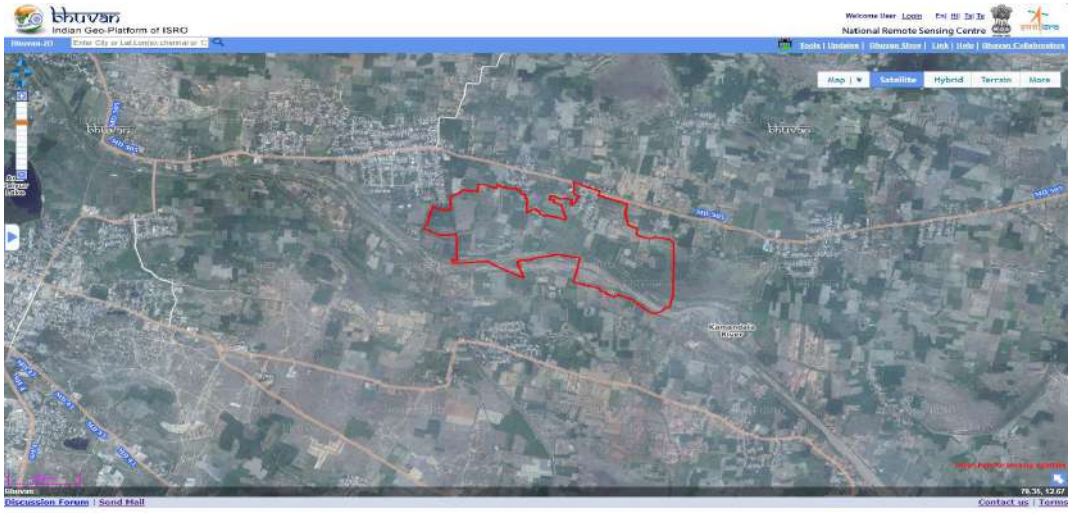


Figure 8.8. Proposed activities in Poosimalaikuppam micro-watershed A: Proposed NRM activities for community. B: Proposed Non-NRM activities for community. C: Proposed NRM activities for Individuals. D: Proposed Non-NRM activities for Individuals

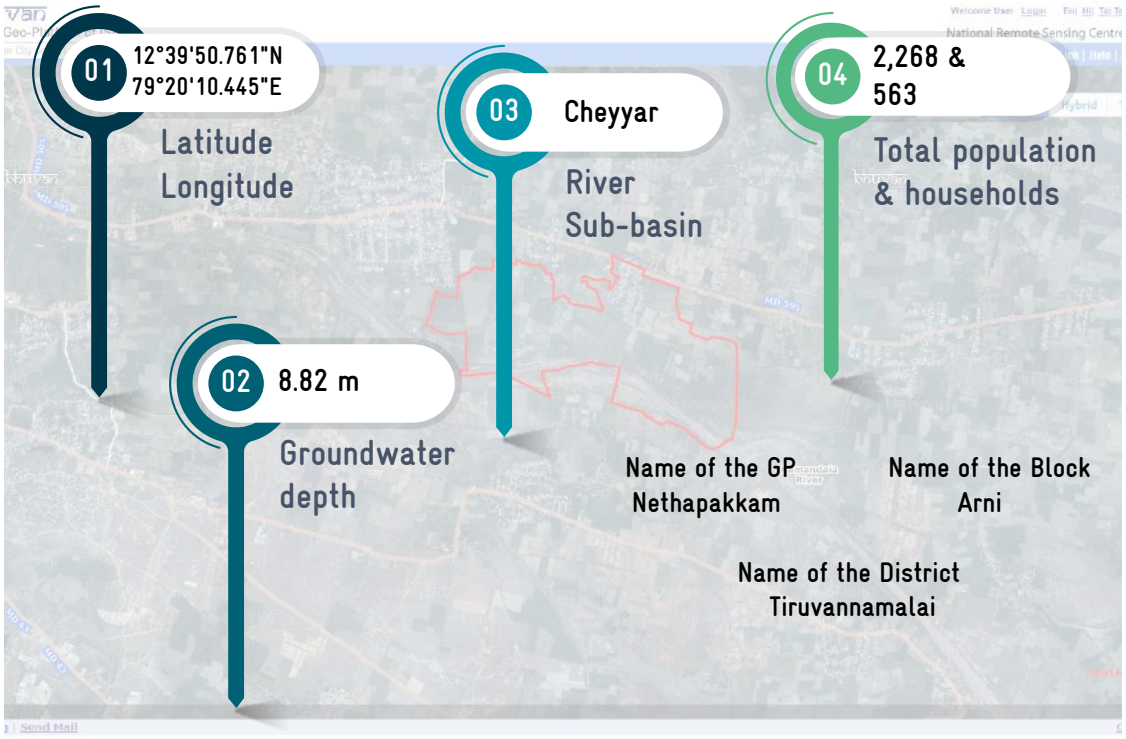
8.3 MODEL GP- NETHAPAKKAM

NETHAPAKKAM GP

8.3.1 BACKGROUND OF GRAM PANCHAYAT – NETHAPAKKAM



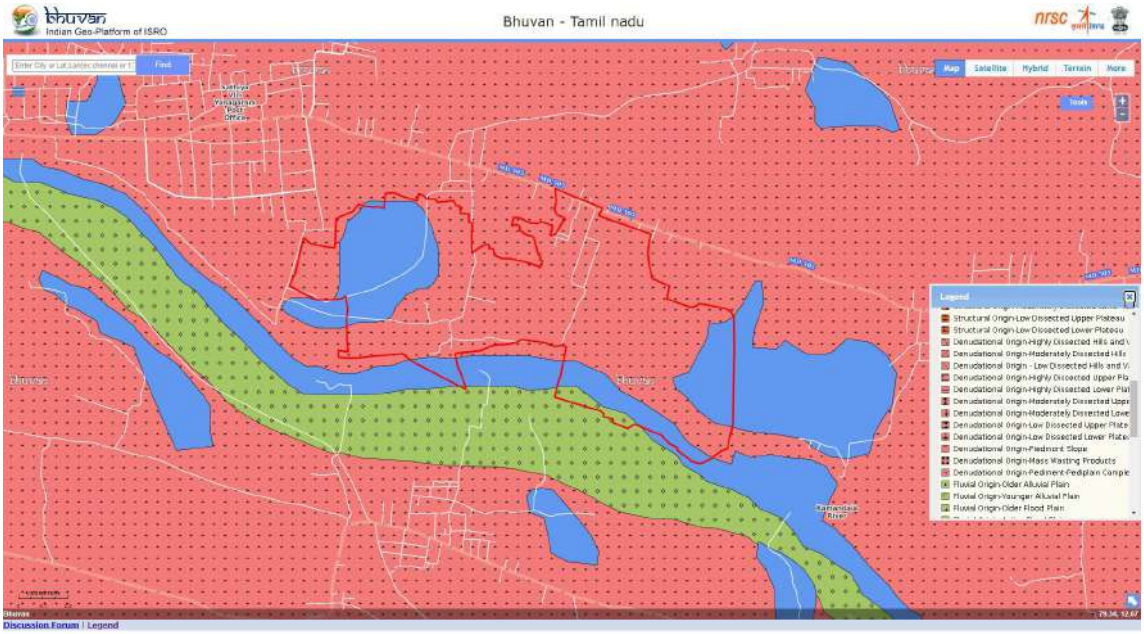
The Nethapakkam GP is geographically situated between 12°39'50.761"N to 79°20'10.445"E and belongs to Arni Block of Tiruvannamalai district. The total geographical area of GP is 95 ha, AS per Census 2011, total population is 2,268 of which 1,143 are males while 1,125 are female population. The total number of households is 563. The ST population is two and SC population is 345 in Nethapakkam village (Table 54). The average annual temperature of GP is 27.9 °C, and receives annual average rainfall of 1,047 mm.

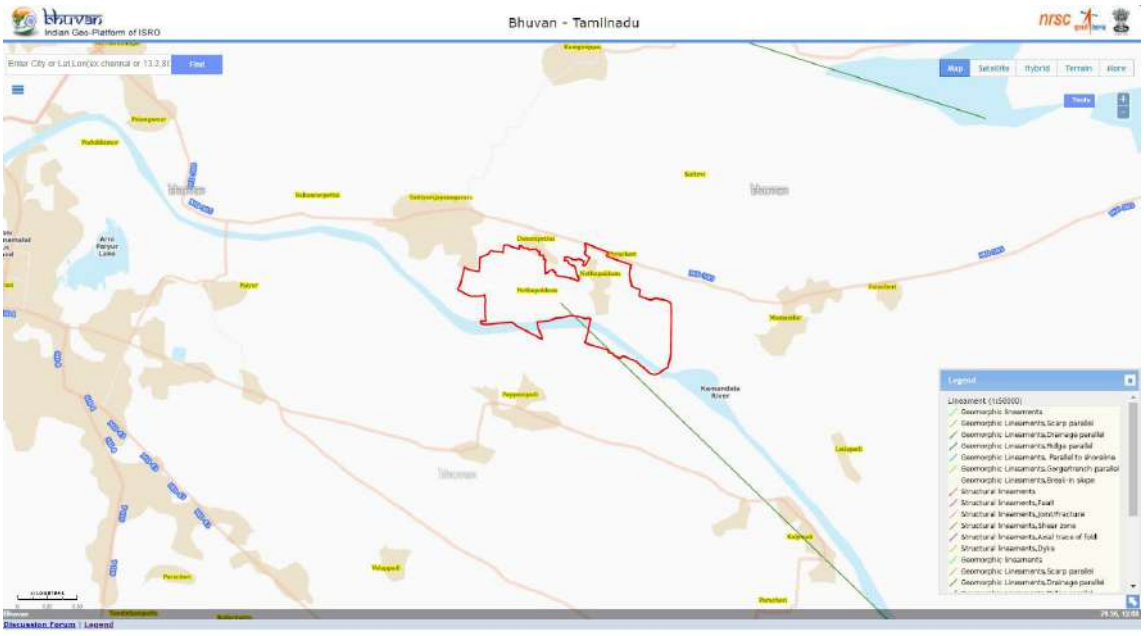


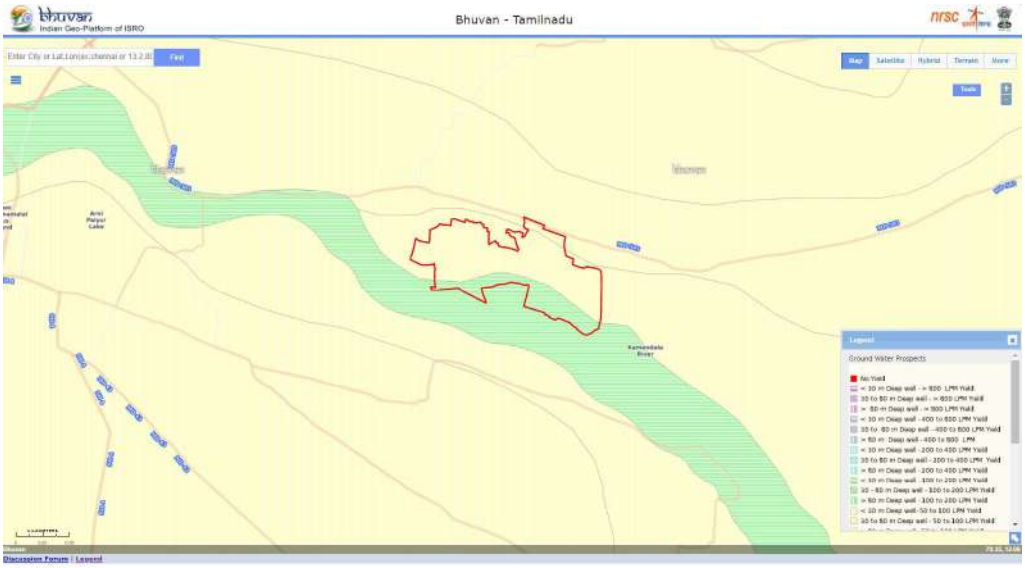
The detailed spatial and non-spatial data considered in the process of preparation of climate resilient under CWRM for Nethapakkam GP is illustrated as follows:

8.3.2 CWRM PLANNING - SPATIAL DATA

CWRM adapted the geospatial technologies in its process of plan preparation towards climate-resilient infrastructure, Water Conservation and Water Harvesting (WCWH) 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 implement towards conservation of resources. Various thematic datasets for Nethapakkam GP (Figure 8.9) are discussed below.



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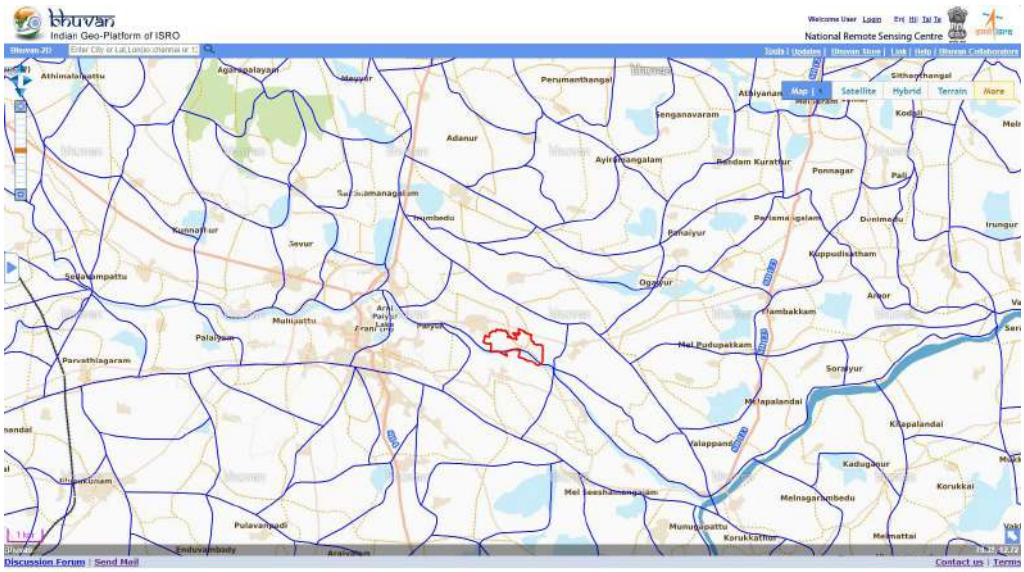
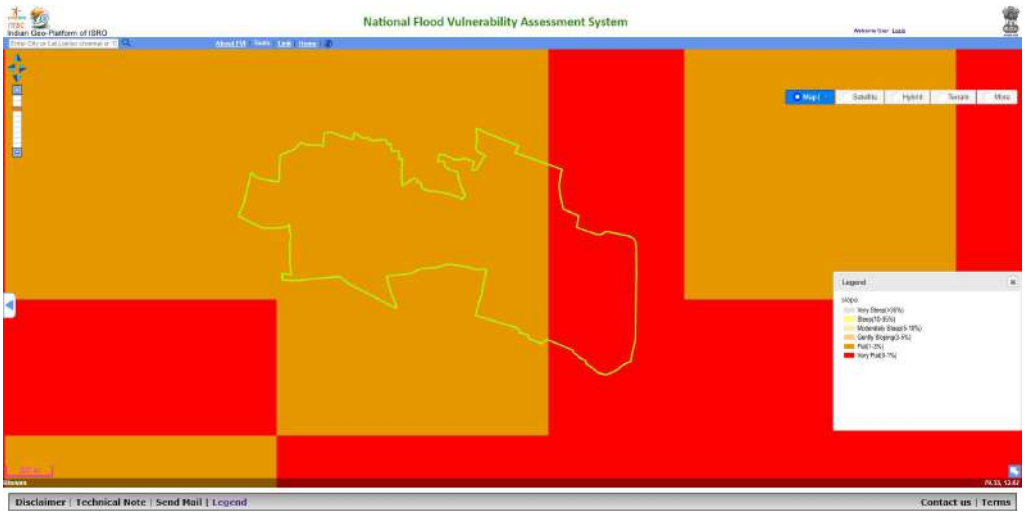

Bhuvan
Indian Geo-Platform of ISRO
National Remote Sensing Centre
Map
Satellite
Hybrid
Terrain
More
Discussion Forum | Send Mail
Contact us | Terms


National Flood Vulnerability Assessment System
Indian Geo-Platform of ISRO
Disclaimer | Technical Note | Send Mail | Legend
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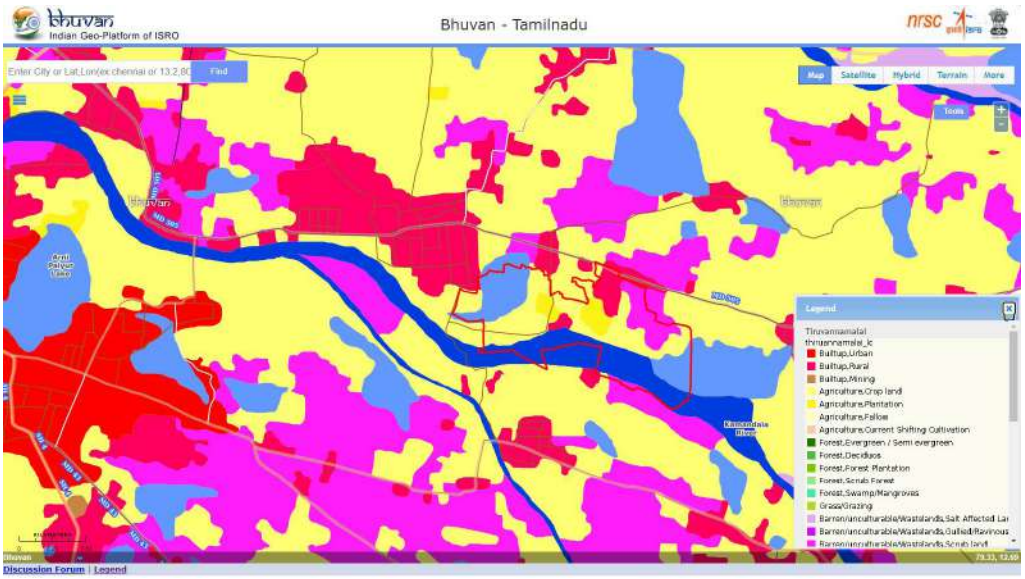


Figure 8.9. Spatial thematic maps of Nethapakkam GP. A. Geomorphology, B. Lineament, C. GW prosperity, D. Watershed, E. Slope, F. LULC

Nethapakkam GP engrossed with denudation origin pediment complex and fluvial landform units (Figure 8.9 A). Geomorphic ridge parallel lineament is noticed in the southern area (B). It is observed that the groundwater prosperity is less than 30 m deep well with 50 to 100 LPM capacity (C). Flat terrain is dominant in the GP (E), Whereas GP area is falls under one micro-watershed units (D). Most of land used for crop cultivation and two large land parcels were indicating the plantation crops (E).

8.3.3 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covered four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 55). These non-spatial data are concurrently used for analysis along with the spatial data mentioned above to identify the key water challenges, prepare water budget by understanding the supply and demand and develop water actions to the different land use and slope categories. The process started with mapping of the administrative (habitations/panchayat/revenue village, Block/thaluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping GP as the lowest unit of planning and execution.

TABLE 55. NON-SPATIAL DATA- NETHAPAKKAM GP

Key CWRM Parameter	Details
Climate Vulnerability Area (CVA) 1: Socio-Economic	
Geographical Area (ha)	95
Male Population	619
Female Population	661
Total Population	1,280
SC Population	1,106
Vulnerable population	1,106
Households (HH's)	585
Only one room HH's (SECC)	37
Female-Headed HH's (SECC)	37

Vulnerable Households (SECC)	37
% of Vulnerable Households	6%
Registered MGNREGA Job cards	344
active person working in job Cards	294
Drinking-Water Sources	284
Groundwater sources - Drinking water	4
Surface water sources - Drinking water	1
Annual Grey water Generation	2.34
Climate Vulnerability Area (CVA) 2: Climate	
Average Annual Rainfall (mm)	1047
Average Annual Temperature (°C)	27.9 °C
Ground Water (GW) Status	Over -Exploited
Climate Vulnerability Area (CVA) 3: Water Resources	
Canal Network (m)	
Length of Main Canal (m)	1,100
Length of Minor Canal	830
Number of Tanks (PWD & Union)	2
Irrigation Facilities (ha)	
Open & Tube Well Irrigation	125
Water Quality (No.)	
Chemical Contaminants	0
Bacterial and Other Contaminants	0
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	233.3
Bad Catchment Area	23.9
Run-Off Conserved (Existing)	
Good Catchment Area	116.89
Average Catchment Area	0.09
Bad Catchment Area	4.78
Watershed and Drainage Networks	
Length of Natural Drainage Lines (m)	2,489
No. of Natural Drainage Lines	1
No.of Micro Watersheds	2
Water Demand (ha.m)	
Water Demand For Humans	3.5
Water Demand for Livestock	5.48
Water Demand For Agriculture	232.45
% G.W Utilization for Drinking	4
% G.W Utilization for Livestock	94
% G.W Utilization for Agriculture	99

% SW Utilization for Drinking	96
% SW Utilization for Livestock	6
% SW Utilization for Agriculture	1
Climate Vulnerability Area 4: Agriculture	
Area Under Land Resources (ha)	
Non-Agricultural Uses	223.04
Barren & Un-cultivable Land	398.98
Cultivable Waste Land	0.42
Unirrigated Land	7.93
Irrigated by Source	119.71
Catchment Area (ha)	
Good Catchment	622.02
Average Catchment	0.42
Bad Catchment	127.64
Crop Details (ha)	
Irrigated Area	211
Rainfed area	3
The area under Paddy Cultivation	125.5
Crop Water Requirement - The irrigated condition	230.8
Crop Water Requirement - Rainfed condition	1.65
Soil Resources: Status of Available Nitrogen (%)	
Low	100
Status of Organic Carbon (%)	
Very Low	19
Low	81
Status of Soil Micro Nutrients (%)	
Sufficient	57
Deficient	43
Status of Physical condition of the soil (%)	
Moderately Alkaline	97
Strongly Alkaline	3
Soil Texture	
% of Fine Soil	100
Soil Water Permeability	Moderate
Soil moisture and ET	
Volumetric Soil Moisture	23%
Estimated Soil Moisture	527.04
ET Losses	66.63
Means of Water Extraction (%)	
Gravity	2

Lifting	98
Irrigation Methods (%)	
Control Flooding	100
Livestock (No)	
Cattle Population	1,398
Sheep Population	251
Goat Population	544

8.3.4 KEY WATER CHALLENGES

Socio-Economic

1. According to SECC data, 6% of the house-holds are vulnerable in the village
2. 37 one room households, and 37 female headed households
3. Access to drinking water through tap water connections is very low
4. Grey water generation is 2.3 ha.m; Han-dling of grey water from households needs attention

Water

1. Ground water staus -Over exploited
2. Two traditional waterbodies in the GP
3. Irrigation depends 100 % on open and tube well
4. 99% Agriculture and 94% livestock need met through groundwater
5. 257.2 ha.m of water is an available runoff -Runoff
6. Good catchment area is more

Agriculture and Allied Sector

1. 82.98 % of the land covers the common area
2. 17% of the land covers an individual land area
3. Main crop in the GP is paddy which is cultivated about 125.5 ha of land
4. Crop water requirement for irrigated condition is more
5. 98% of the water is given to paddy fields by lifting methods of irrigation
6. Remaining water is extracted by gravity method of irrigation
7. Soil Nitrogen, organic carbon is low
8. Moderately Alkaline soil
9. Fine soil is predominant in the GP
10. Slightly high ET loss at 66.63 ha.m

8.3.5 PERSPECTIVE PLAN - WORKS PROPOSED: WATER ACTIONS

The appropriate and site-specific works are identified for the development of public and common land, agriculture and allied activities, rural infrastructures, and climate-resilient to reduce the vulnerability of the GP. About 44.48% of the total land area is taken for WASCA treatment activities like plantation and conservation works. The total proposed area for treatment is 321.19 ha with more attention being given for Barren and Un-cultivable land, followed Non agricultural uses land and area under irrigated by source (Figure 8.10). Through the proposed conservation activities, 121.76 ha.m run off would be harvested in which, about 96% of the runoff from the good catchment, 3.9% of the runoff from the bad catchment and negligible amount of conservation from the average catchment area (Figure 8.11).

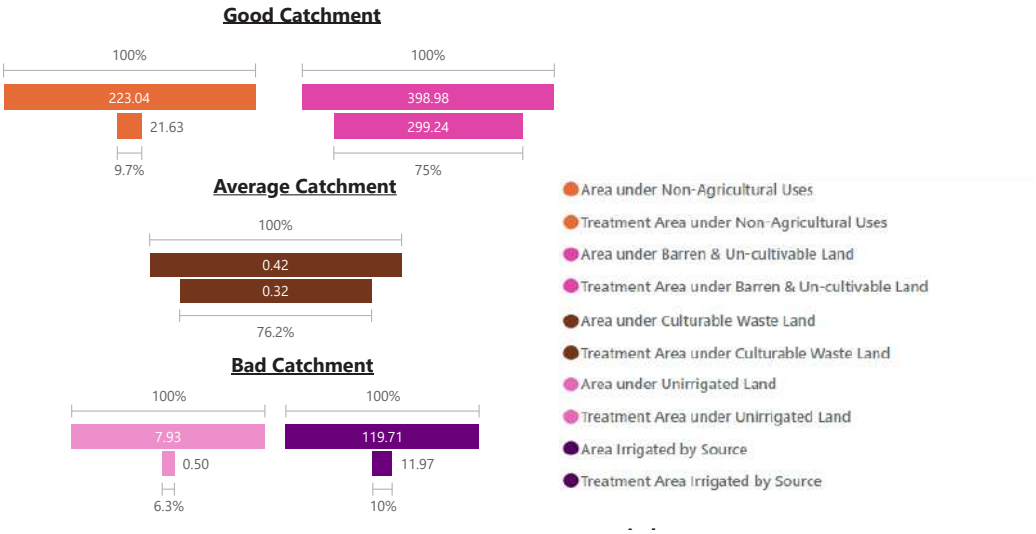


Figure 8.10. Proposed land resource treatment area in Nethapakkam GP

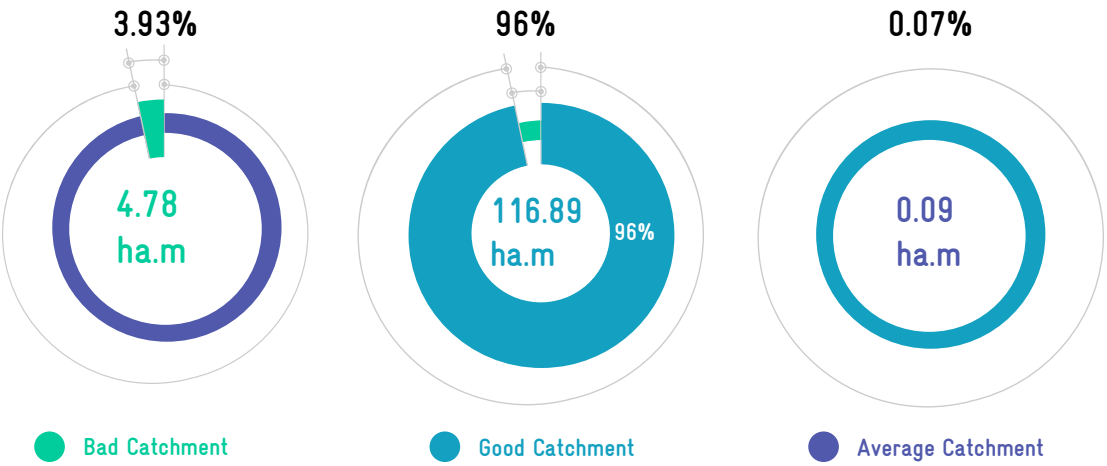


Figure 8.11. Expected run off conservation after treatment in Nethapakkam GP

The detailed proposed activities along with silent parameters are showed in the Table 56 for 2021-2024. More attention towards common and public land developments are given with appropriate works to improve the resilience of the GP.

TABLE 56. PERSPECTIVE PLAN OF NETHAPAKKAM GP - FY (2021-2024)

CWRM Water Action 1. Improvement of Public & Common lands development				
Name of the Work	**Ridge Type**	**No of Works**	**Estimated cost (INR in Lakhs)**	**Estimated Person Days**
Contour Continuous Bunds (CCB) for Afforestation area (m)	Upper	1	0.03	10
Composting (No.)	Lower	68	11.56	1,020
Afforestation in Public/common lands(ha)	Middle	2	17.2	6,688
Block Plantation (Community) (ha)		2	22.2	8,640
Linear Plantation (km)		6	10.8	4,218
Avenue Plantation (km)		3	5.4	2,109
Restotaration of water bodies: a.PWD and Tanks (No.)	Lower	2	10	1,600
Artificial Recharge Structure (No.)	Upper	50	125	19,550
Drainage Line Treatment (m)		3	0.09	15
Sub total		**137**	**202.28**	**43,850**
Agriculture & Allied Sector Development				
Farm Bunding with Boundary Trenches - Individual (ha)	Lower	2	3	1,172
Micro Irrigation (ha)		12	12	0
Construction of Farm Ponds - Individual (No.)		10	20	7,810
Land development - Individual (ha)		3	30	11,718
Dry land Horticulture/Agro forestry - Individual (ha)		3	25.5	9,963
Azolla units - Individual (No.)		35	5.25	805
NADEP Vermi compost (No.)		35	6.3	945
Fodder development - Community & Individual		35	51.8	82,040
Cattle Shelters (No.)		35	74.2	11,585
Goat Sheep Shelters (No.)		18	40.86	6,390
Cattle Trough (No.)		35	1.75	210
Sub total		**223**	**270.66**	**1,32,638**
Rural Water Management				
Soak Pits (Community) (No.)	Lower	3	0.39	60
Soak Pits (Individual) (No.)		29	2.9	464
Roof Rain Water Harvesting (No.)		2	8	1,250
Sub total		**34**	**11**	**1,774**
Total		**394**	**483.94**	**1,78,262**

Regarding CWRM themes of the total number of projects identified, 56.59 % works are in agriculture and allied sector while 34.77% and 8.62 % works are in public and common land, and rural infrastructure respectively. Table 57 provides the estimates of the work budget, and personal days for three years from 2021-2024 in the Nethapakkam GP.

TABLE 57. 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	137	202.28	43,850
Agriculture and Allied sector development	223	270.66	1,32,638
Rural water management	34	11	1,774
TOTAL	394	483.94	1,78,262

8.3.6 IMPACTS

The proposed water actions based on the above key water challenges cover a period of three years from 2021- 2022 to 2023-2024, At the end of the implementation period i.e. in the year 2024, the following impacts are envisaged (Table 58). It is expected that the impacts will potentially reduce the vulnerability and improve the resilience of the system to the projected climatic change events and ensured water security.

TABLE 58. 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	Two traditional water bodies restored
2	Percentage reduction in the annual surface runoff	2	4.8 ha.m surface runoff harvested and stored
3	The proportion of land treated under WASCA	3	43% of the total geographical area of the village treated under WASCA in three years
4	Drainage line treatment	4	2,489 m length of drainage lines treated

2 TRADITIONAL WATER BODIES RESTORED

4.8 ha.m SURFACE RUNOFF HARVESTED

43 % AREA OF THE VILLAGE TREATED

2,489 m DRAINAGE LINES TREATED

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR		OUTCOMES/ IMPACT
1.	No of structures were established for on-farm (in-situ) water harvesting in dry lands	1.	10 farm ponds established
2.	Improvement in soil health	2.	35 units of vermi compost established
3.	No of artificial recharge structures pro-posed	3.	33 artificial recharge structures were established to replenish groundwater flow

10 FARM PONDS

35 VERMI COMPOST

33 ARTIFICIAL RECHARGE STRUCTURES

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

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

OUTCOMES/ IMPACT	
1.	3 community level and 29 individual level soak pits were constructed for grey water management to maintain hygiene in the village
2.	Two units of roof rainwater harvesting and storing established
3.	585 households established Nutri-gardens in homesteads

3 COMMUNITY & **29** INDIVIDUAL SOAK PITS

2 COMMON ROOF RAINWATER HARVESTING

585 NUTRI-GARDENS

Table 59 provides both the perspective plan for three years' period and the annual plan for the one-year period from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 59. PROPOSALS FOR THE MGNREGS, NETHAPAKKAM GP, TIRUVANNAMALAI DISTRICT

	No of works	No of person days
Perspective plan	394	1,78,262
Annual plan	145	66,800

8.3.7 PROPOSED ACTIVITY MAP

The proposed activity map for Nethapakkam GP, Arni Block shows a shelf of projects for all three year works from 2021-2024 (Figure 8.12 to 8.15).

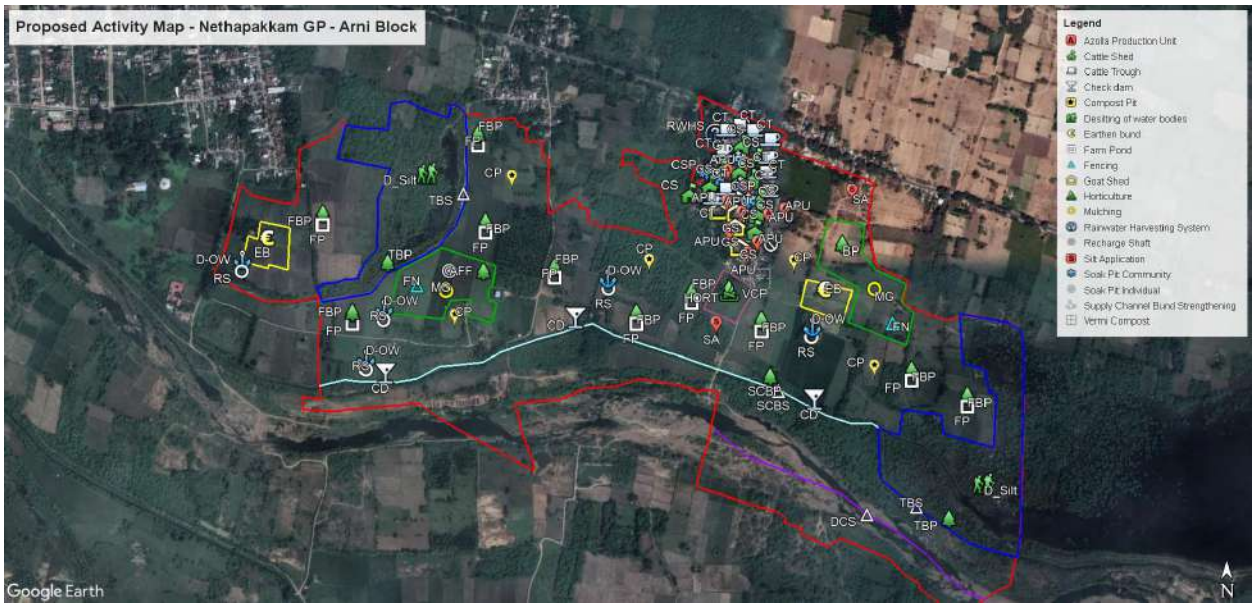


Figure 8.12. Proposed action plan of Nethapakkam GP

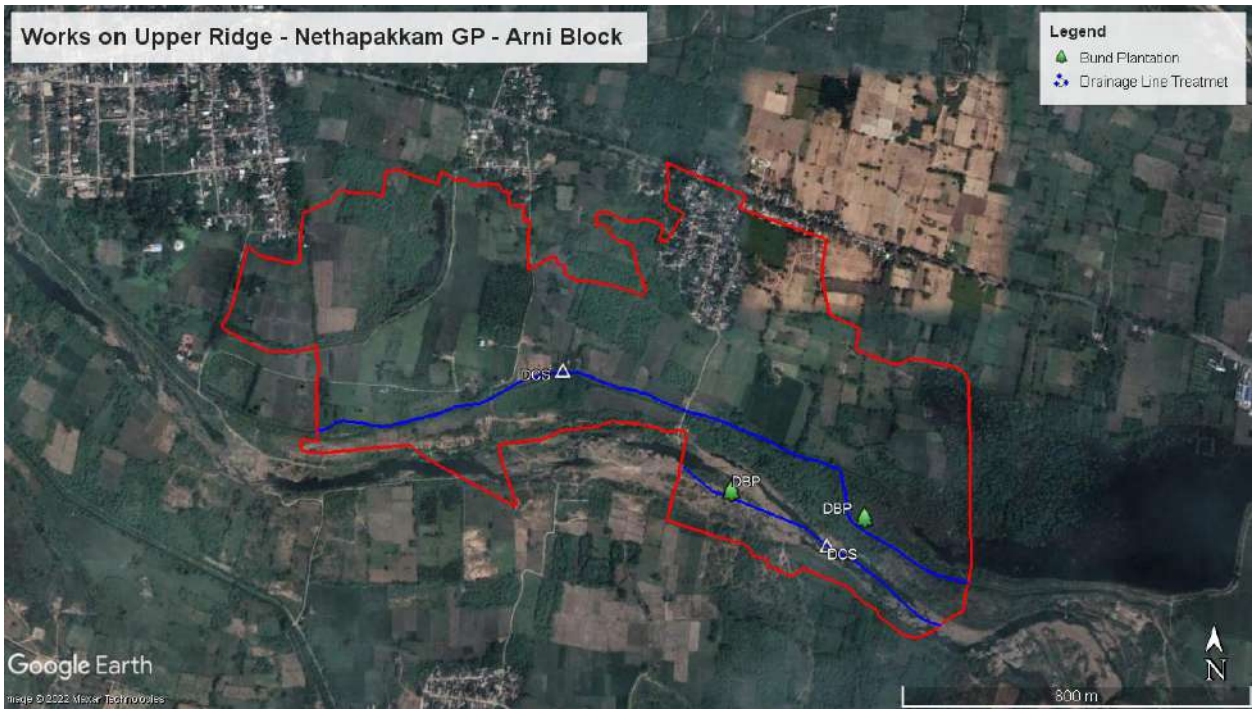


Figure 8.13. Works on Upper Ridge of Nethapakkam GP

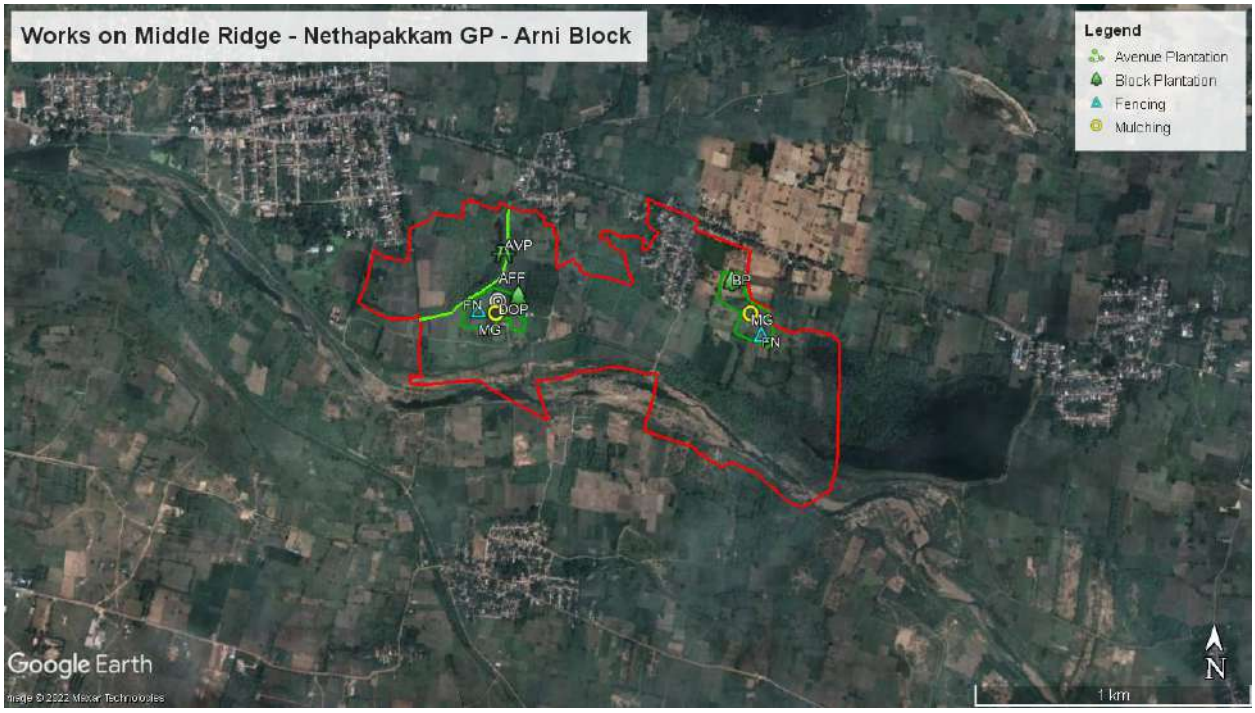


Figure 8.14. Works on Middle Ridge of Nethapakkam GP

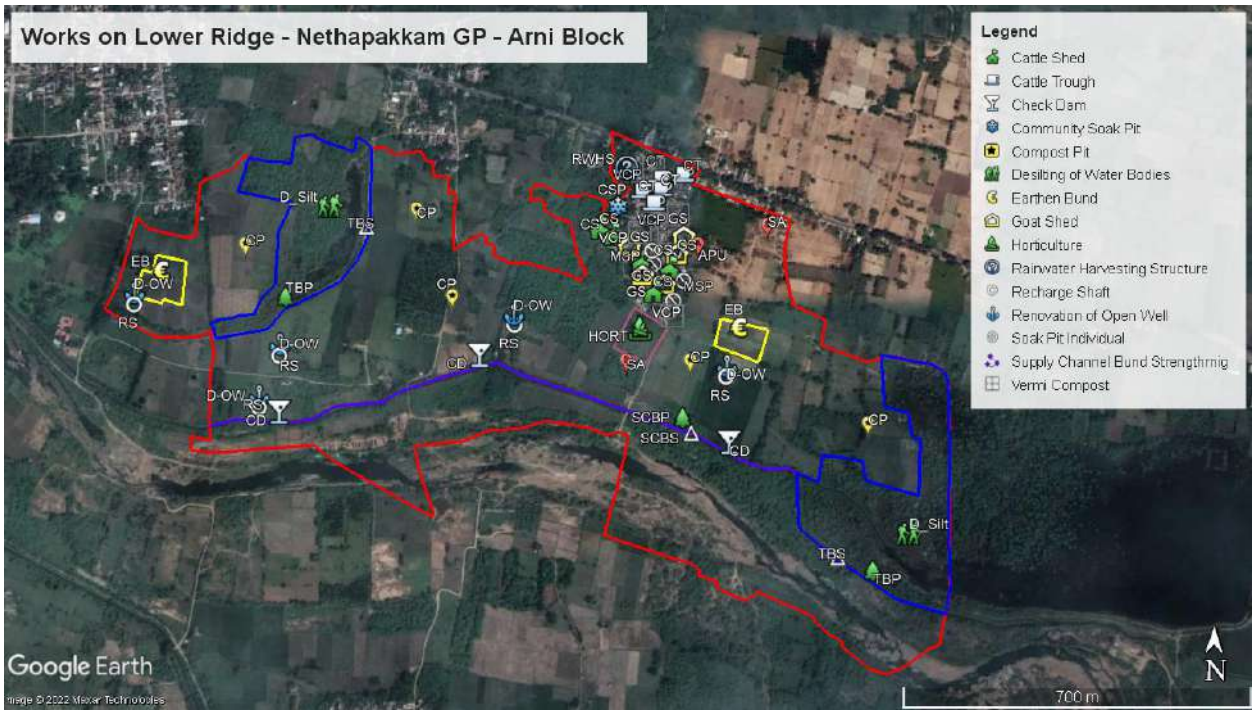
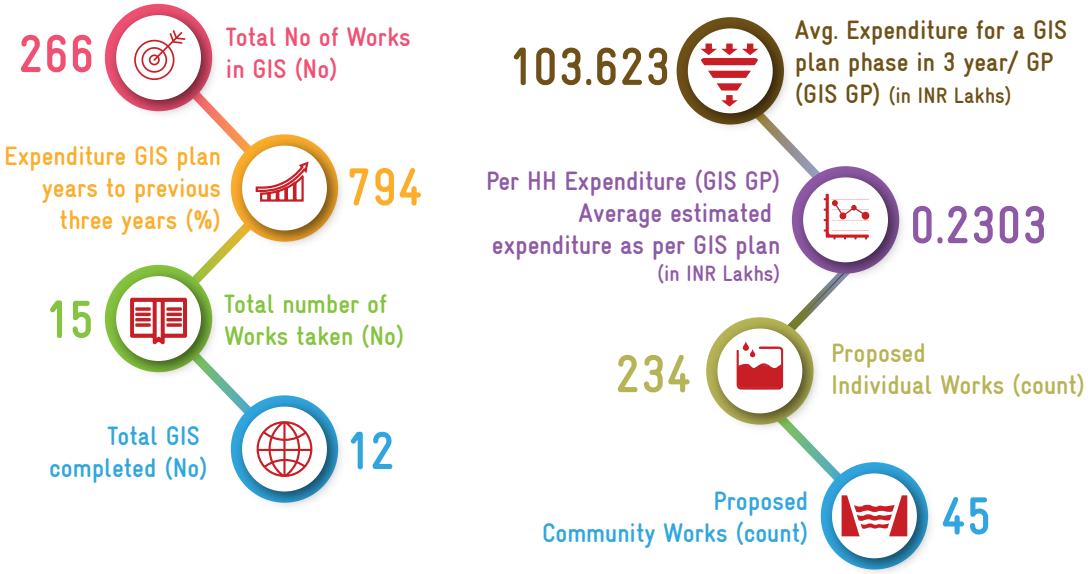


Figure 8.15. Works on Lower Ridge of Nethapakkam GP

8.3.8 GIS PLAN IMPLEMENTATION, KEY PARAMETERS

The GIS plan implementation and performance of Naduppatu Block is represented in Table 60.

TABLE 60. KEY PARAMETERS PERFORMANCE IN NETHAPAKKAM GP -ARNI BLOCK



நீர்இன்று அமையாது உலகெனின் யார்யார்க்கும்
வான்இன்று அமையாது ஒழுக்கு

குறள் - 20

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

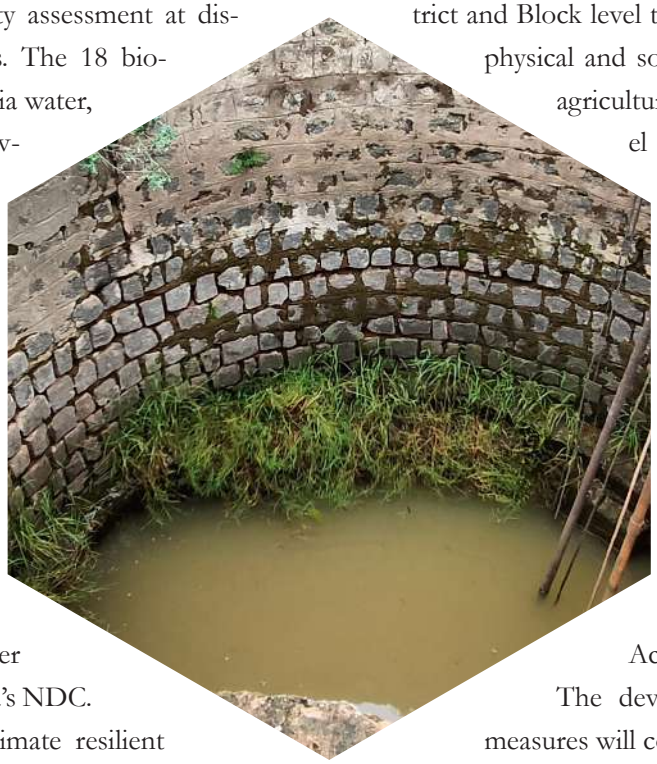
Thirukkural - 20

CHAPTER 9

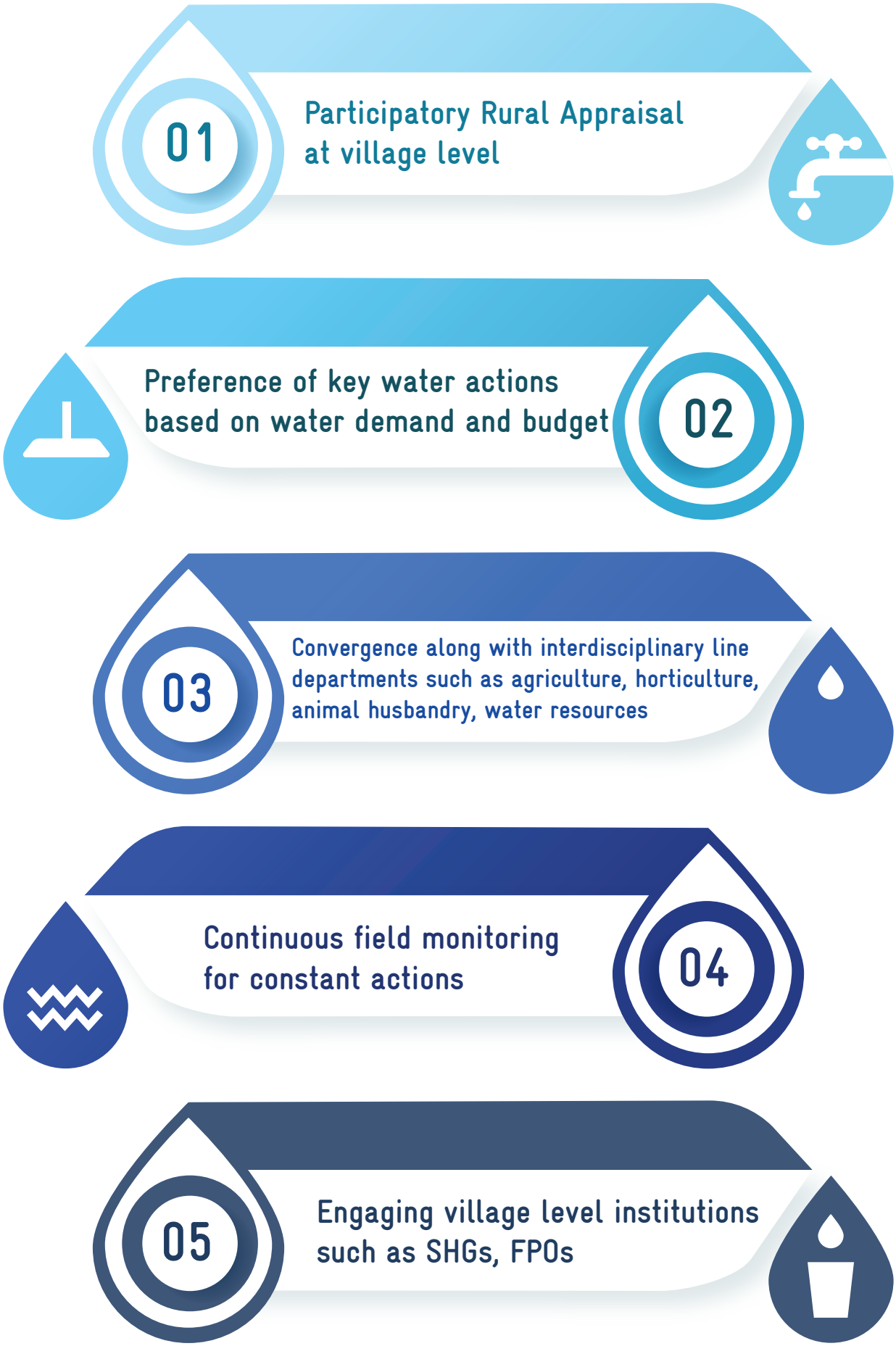
CONCLUSION

> **"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

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

Gram Panchayat	Canal Network (m)				Tradational Water bodies		
	Length of Main Canal	Length of Minor Canal	Length of Distributaries	Water Courses (Field Channels)	Number of Tanks (PWD & Union)	Number of Ooranis	Other Surface Water Bodies
Adaiyapulam	6,150	-	-	7,280	4	1	6
Adanur	6,200	-	-	9,180	3	2	6
Agarapalayam	4,000	1,500	-	-	1	-	3
Irumbedu	5,000	1,000	-	-	4	-	4
Morappanthangal	3,000	1,250	-	-	4	-	5
Meyyur	3,500	1,200	-	-	4	-	2
Puthur	7,660	-	-	9,850	2	-	6
Poosimalaikuppam	7,290	-	-	11,050	1	-	4
Randam Korattur	2,100	185	-	1,050	3	-	3
Vedugasathu	2,100	185	-	1,050	4	-	2
Vettiyantholuvan	5,450	-	-	6,980	3	-	1
Rattinamanagalam	4,540	-	-	7,590	1	-	2
Chitheri	1,500	720	-	-	1	-	1
Velapadi	1,800	360	-	-	7	-	2
Kalleripattu	2,500	1,800	-	-	3	-	2
Mattathari	2,500	1,800	-	-	2	-	3
Ladavaram	1,500	750	-	-	2	-	3
Mamandur	1,800	700	-	-	2	-	4
Ladapadi	1,800	650	-	-	1	-	2
Katteri	1,300	700	-	-	4	-	1
Molugampoondi	2,800	1,300	-	-	2	-	1
Kalpoondi	1,800	900	-	-	2	-	2
Mullandram	-	-	-	-	2	-	4

Gram Panchayat	Canal Network (m)				Tradational Water bodies		
	Length of Main Canal	Length of Minor Canal	Length of Distributaries	Water Courses (Field Channels)	Number of Tanks (PWD & Union)	Number of Ooranis	Other Surface Water Bodies
Vedajipuram	2,100	1,100	-	-	1	-	2
Sathiyavijayanagaram	1,800	750	-	-	-	-	3
Nethapakkum	1,100	830	-	-	2	-	-
Kanigiluppai	1,600	500	-	-	7	-	3
Pudupattu	1,800	950	-	-	-	-	1
Vilai	850	700	-	-	-	-	1
Nesal	2,200	1,200	-	-	2	-	4
Sirumur	2,300	1,800	-	-	2	-	1
Srinivasa Udayavanam	1,300	900	-	-	2	-	-
Velleri	1,100	580	-	-	2	-	2
Sangeethavadi	1,300	800	-	-	4	-	6
Paniyur	2,300	1,200	-	-	6	-	2
Ariyapadi	1,800	720	-	-	1	-	3
Savoor	-	-	-	-	3	-	3
Paiyur	1,500	850	450	-	2	-	3

Gram Panchayat	Irrigation Facilities (ha)		Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Area under Tank Irrigation	Area under 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.)
Adaiyapulam	-	183	133	1	63	4,545	7	5
Adanur	-	221	132	-	75	5,819	6	4
Agarapalayam	-	162	137	1	60	6,563	4	6
Irumbedu	30	114	170	3	74	3,220	5	9
Morappanthangal	40	70	143	-	77	12,059	7	8
Meyyur	-	212	71	-	61	260	1	5
Puthur	-	94	145	9	77	3,718	6	4
Poosimalaikuppam	20	104	66	-	49	7,418	6	4
Randam Korattur	-	69	142	-	16	2,056	4	2
Vedugasathu	-	126	69	-	131	4,764	7	7
Vettiyantholuvan	-	130	39	-	203	-	-	-
Rattinamanagalam	36	184	104	-	38	2,220	1	5
Chitheri	-	131	64	84	114	1,441	3	4
Velapadi	-	131	64	84	114	-	-	5
Kalleripattu	-	125	64	84	114	-	-	3
Mattathari	-	113	181	-	60	2,200	3	6
Ladavaram	-	206	181	-	60	1,440	2	6
Mamandur	-	220	200	-	75	2,944	3	6
Ladapadi	-	115	200	-	75	3,597	3	3
Katteri	-	115	200	-	75	1,268	2	5
Molugampoondi	-	62	168	-	34	3,126	2	3
Kalpoondi	-	102	168	-	34	1,498	2	3
Mullandram	-	130	293	-	66	9,388	12	6
Vedajipuram	-	140	293	-	66	2,769	4	3
Sathiyavijayanagaram	-	120	233	-	24	707	1	3

Gram Panchayat	Irrigation Facilities (ha)		Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	Area under Tank Irrigation	Area under 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.)
Nethapakkum	-	125	233	-	24	720	1	2
Kanigiluppai	-	119	233	-	24	1,542	3	4
Pudupattu	-	126	141	0	61	35	1	3
Vilai	-	191	141	0	61	604	1	3
Nesal	-	141	141	0	61	2,910	4	3
Sirumur	50	239	165	4	353	3,841	7	5
Srinivasa Udayavanam	50	239	165	4	353	8,081	13	6
Velleri	-	250	259	-	60	1,353	3	5
Sangeethavadi	-	135	259	-	60	1,277	3	4
Paniyur	-	278	259	9	117	5,871	4	8
Ariyapadi	60	242	128	-	143	5,808	7	6
Savoor	-	200	155	-	42	1,227	2	4
Paiyur	-	128	64	12	32	-	-	5

Gram Panchayat	Water Demand								
	Water Demand For Humans (ha)	Water Demand for Livestock (ha)	Water Demand For Agriculture (ha)	% 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
Adaiyapulam	2	2	391	100	95	96	-	5	4
Adanur	11	13	365	98	97	97	2	3	3
Agarapalayam	9	3	408	11	94	99	89	6	1
Irumbedu	9	3	273	10	89	99	90	11	1
Morappanthangal	9	0	193	86	4	94	14	96	6
Meyyur	7	2	342	10	91	97	90	9	3
Puthur	5	2	305	5	92	97	95	8	3
Poosimalaikuppam	7	3	174	88	92	94	12	8	6
Randam Korattur	4	1	210	5	94	99	95	6	1
Vedugasathu	14	6	369	13	95	96	87	5	4
Vettiyantholuvan	5	2	311	5	96	94	95	4	6
Rattinamanagalam	12	2	251	90	87	98	10	13	2
Chitheri	9	6	276	3	90	98	97	10	2
Velapadi	10	6	276	3	90	98	97	10	2
Kalleripattu	5	6	276	3	90	98	97	10	2
Mattathari	5	6	324	4	94	97	96	6	3
Ladavaram	6	6	324	2	94	97	98	6	3
Mamandur	7	4	325	3	82	97	97	18	3
Ladapadi	2	4	325	2	82	97	98	18	3
Katteri	5	4	325	1	82	97	99	18	3
Molugampoondi	5	4	262	4	90	98	96	10	2
Kalpoondi	4	4	262	3	90	98	97	10	2
Mullandram	12	4	416	2	95	96	98	5	4
Vedajipuram	2	4	416	2	95	96	98	5	4
Sathiyavijayanagaram	16	5	232	2	94	99	98	6	1
Nethapakkum	4	5	232	4	94	99	96	6	1

Gram Panchayat	Water Demand								
	Water Demand For Humans (ha)	Water Demand for Livestock (ha)	Water Demand For Agriculture (ha)	% G.W Utilization for Drinking	% G.W Utilization for Livestock	% G.W Utilzation for Agriculture.	% SW Utilization for Drinking	% SW Utilization for Livestock	% SW Utilization for Agriculture
Kanigiluppai	4	5	232	3	69	99	97	31	1
Pudupattu	4	6	335	5	90	97	95	10	3
Vilai	3	6	335	3	90	97	97	10	3
Nesal	5	6	335	4	90	97	96	10	3
Sirumur	8	7	361	2	95	93	98	5	7
Srinivasa Udayavanam	6	7	361	3	95	93	97	5	7
Velleri	4	4	283	2	93	99	98	7	1
Sangeethavadi	6	4	283	3	93	99	97	7	1
Paniyur	21	5	162	1	90	95	99	10	5
Ariyapadi	3	5	414	1	91	93	99	9	7
Savoor	28	3	298	-	87	90	100	13	10
Paiyur	21	5	159	1	90	97	99	10	3

ANNEXURE 3.7

GP WISE STATUS OF AGRICULTURE RESOURCE

Gram Panchayat	Area under Land Resources (ha)								
	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 Criticalops etc.	Area under Culturable Waste Land	Area under Fallows Land other than Current Fallows	Area under Current Fallow land	Area under Unirrigated Land	Area Irrigated by Source
Adaiyapulam	191	164	-	-	2	-	-	151	183
Adanur	208	145	-	-	-	-	142	40	221
Agarapalayam	153	214	-	-	3	-	-	159	162
Irumbedu	216	236	-	-	12	6	242	6	141
Morappanthangal	79	302	-	-	-	-	159	142	110
Meyyur	94	95	-	-	-	21	19	72	212
Puthur	44	344	-	-	34	-	243	74	94
Poosimalaikuppam	96	80	-	-	-	-	121	36	104
Randam Korattur	132	246	-	-	-	-	-	18	69
Vedugasathu	184	-	-	-	-	250	317	6	126
Vettiyantholuvan	103	-	-	-	-	3	891	60	130
Rattinamanagalam	92	184	-	-	-	-	1	16	184
Chitheri	171	-	-	-	-	300	115	0	194
Velapadi	171	-	-	-	-	300	115	0	194
Kalleripattu	171	-	-	-	-	300	115	0	194
Mattathari	108	374	-	-	-	-	14	102	206
Ladavaram	108	374	-	-	-	-	14	102	206
Mamandur	118	416	-	-	-	-	75	75	249
Ladapadi	118	416	-	-	-	-	75	75	249
Katteri	118	416	-	-	-	-	75	75	249
Molugampoondi	172	274	-	-	-	-	25	92	62
Kalpoondi	172	274	-	-	-	-	25	92	62
Mullandram	224	558	-	-	-	-	15	124	216

Gram Panchayat	Area under Land Resources (ha)								
	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 Critica-lops etc.	Area under Culturable Waste Land	Area under Fallows Land other than Current Fallows	Area under Current Fallow land	Area under Unirrigated Land	Area Irrigated by Source
Vedajipuram	224	558	-	-	-	-	15	124	216
Sathiyavijayanagaram	223	399	-	-	0	-	-	8	120
Nethapakkum	223	399	-	-	0	-	-	8	120
Kanigiluppai	223	399	-	-	0	-	-	8	120
Pudupattu	101	274	0	-	170	-	194	11	123
Vilai	101	274	0	-	170	-	194	11	123
Nesal	101	274	0	-	170	-	194	11	123
Sirumur	110	314	14	-	1	-	1,434	165	289
Srinivasa Udayavanam	110	314	14	-	1	-	1,434	165	289
Velleri	113	577	-	-	-	-	-	72	250
Sangeethavadi	113	577	-	-	-	-	-	72	250
Paniyur	334	356	22	3	7	-	230	117	278
Ariyapadi	178	162	-	-	-	200	175	87	302
Savoor	141	273	-	-	-	-	26	-	200
Paiyur	52	118	0	-	41	29	12	-	128

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Land under Good Catchment	Land under Average Catchment	Land under Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Area under Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Adaiyapulam	355	2	334	258	37	227	376	15
Adanur	352	-	403	282	27	207	354	11
Agarapalayam	366	3	321	282	11	253	403	4
Irumbedu	452	12	396	200	4	158	271	2
Morappanthangal	380	-	411	134	22	103	182	11
Meyyur	189	-	323	214	30	147	330	12
Puthur	388	34	410	228	26	162	295	11
Poosimalaikuppam	176	-	261	143	22	93	163	11
Randam Korattur	379	-	86	179	2	117	209	1
Vedugasathu	184	-	699	244	38	231	354	15
Vettiyantholuvan	103	-	1,084	191	48	170	293	18
Rattinamanagalam	276	-	201	176	12	154	247	4
Chitheri	171	-	609	194	15	172	269	7
Velapadi	171	-	609	194	15	172	269	7
Kalleripattu	171	-	609	194	15	172	269	7
Mattathari	482	-	322	261	31	185	313	11
Ladavaram	482	-	322	261	31	185	313	11
Mamandur	534	-	398	247	22	187	316	9
Ladapadi	534	-	398	247	22	187	316	9
Katteri	534	-	398	247	22	187	316	9
Molugampoondi	447	-	179	206	11	154	258	4
Kalpoondi	447	-	179	206	11	154	258	4
Mullandram	782	-	354	311	44	225	400	16
Vedajipuram	782	-	354	311	44	225	400	16
Sathiyavijayanagaram	622	0	128	211	3	126	231	2
Nethapakkum	622	0	128	211	3	126	231	2

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Land under Good Catchment	Land under Average Catchment	Land under Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Area under Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Kanigiluppai	622	0	128	211	3	126	231	2
Pudupattu	375	170	327	235	22	206	327	8
Vilai	375	170	327	235	22	206	327	8
Nesal	375	170	327	235	22	206	327	8
Sirumur	425	16	1,888	212	64	159	335	26
Srinivasa Udayavanam	425	16	1,888	212	64	159	335	26
Velleri	690	-	322	249	4	162	281	2
Sangeethavadi	690	-	322	249	4	162	281	2
Paniyur	690	31	625	107	13	101	155	8
Ariyapadi	340	-	764	265	82	209	384	30
Savoor	414	-	226	179	44	164	269	29
Paiyur	170	41	170	106	14	101	154	5

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Soil Micro Nutrients (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
Adaiyapulam	48.57	51.43	-	-	-	30.00	64.29	4.29	-	1.43	55	45
Adanur	4.04	69.70	26.26	-	-	21.21	76.77	2.02	-	-	57	43
Agarapalayam	75.20	24.80	-	-	-	60.26	39.74	-	-	-	51	49
Irumbedu	-	80.68	19.32	-	-	66.23	33.77	-	-	-	34	66
Morappanthangal	8.62	66.09	25.29	-	-	38.82	52.94	8.24	-	-	45	55
Meyyur	17.39	71.74	10.33	0.54	-	42.86	57.14	-	-	-	51	49
Puthur	39.13	56.52	4.35	-	-	50.00	46.30	3.70	-	-	42	58
Poosimalaikuppam	22.79	70.59	6.62	-	-	53.42	46.58	-	-	-	42	58
Randam Korattur	70.08	27.56	2.36	-	-	9.68	90.32	-	-	-	58	42
Vedugasathu	-	75.00	25.00	-	-	3.70	96.30	-	-	-	43	57
Vettiyantholuvan	17.24	81.03	1.72	-	-	37.93	60.34	1.72	-	-	48	52
Rattinamanagalam	6.94	76.39	16.67	-	-	23.61	61.11	13.89	-	1.39	50	50
Chitheri	14.93	82.09	2.99	-	-	29.41	69.12	1.47	-	-	54	46
Velapadi	11.61	62.58	25.16	0.65	-	29.41	69.12	1.47	-	-	54	46
Kalleripattu	14.13	84.78	1.09	-	-	9.78	88.04	2.17	-	-	57	43
Mattathari	1.98	64.36	33.66	-	-	7.92	90.10	1.98	-	-	50	50
Ladavaram	3.92	96.08	-	-	-	33.33	66.67	-	-	-	43	57
Mamandur	56.10	41.46	2.44	-	-	36.59	53.66	9.76	-	-	36	64
Ladapadi	56.10	41.46	2.44	-	-	36.59	53.66	9.76	-	-	36	64
Katteri	47.54	47.54	4.92	-	-	49.18	42.62	4.92	-	3.28	36	64
Molugampoondi	-	68.75	31.25	-	-	15.63	62.50	21.88	-	-	47	53
Kalpoondi	35.65	56.94	7.41	-	-	32.41	41.67	25.46	0.46	-	47	53
Mullandram	10.05	73.68	16.27	-	-	26.79	66.99	6.22	-	-	56	44
Vedajipuram	14.41	61.86	23.73	-	-	39.83	49.15	11.02	-	-	56	44
Sathiyavijayanagaram	28.00	62.67	9.33	-	-	9.33	89.33	1.33	-	-	55	45
Nethapakkum	-	100.00	-	-	-	19.44	80.56	-	-	-	57	43

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Soil Micro Nutrients (%)					Status of Soil Micro Nutrients (%)	
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	Sufficient	Deficient
Kanigiluppai	50.00	50.00	-	-	-	-	100.00	-	-	-	65	35
Pudupattu	74.51	25.49	-	-	-	37.25	62.75	-	-	-	63	37
Vilai	74.51	25.49	-	-	-	37.25	62.75	-	-	-	63	37
Nesal	45.45	54.55	-	-	-	-	-	100.00	-	-	52	48
Sirumur	13.64	61.04	25.32	-	-	29.41	58.82	11.76	-	-	51	49
Srinivasa Udayavanam	13.64	61.04	25.32	-	-	29.41	58.82	11.76	-	-	51	49
Velleri	3.61	86.75	9.64	-	-	30.95	69.05	-	-	-	48	52
Sangeethavadi	3.61	86.75	9.64	-	-	30.95	69.05	-	-	-	48	52
Paniyur	30.43	65.22	4.35	-	-	-	22.86	77.14	-	-	55	45
Ariyapadi	29.76	69.05	1.19	-	-	67.86	32.14	-	-	-	58	42
Savoor	9.09	62.12	28.79	-	-	25.76	51.52	22.73	-	-	45	55
Paiyur	30.43	65.22	4.35	-	-	-	22.86	77.14	-	-	55	45

Gram Panchayat	Status of Physical condition of the soil (%)							
	Acidic Sulphate	Strongly Acidic	Highly Acidic	Moderately Acidic	Slighly Acidic	Neutral	Moderately Alkaline	Strongly Alkaline
Adaiyapulam	-	-	-	-	-	-	100.00	-
Adanur	1.01	-	-	4.04	1.01	1.01	92.93	-
Agarapalayam	-	-	-	-	-	15.38	84.62	-
Irumbedu	-	-	-	-	15.58	7.79	76.62	-
Morappanthangal	-	-	-	-	2.35	7.06	89.41	1.18
Meyyur	-	-	-	-	-	-	100.00	-
Puthur	-	-	-	-	-	-	100.00	-
Poosimalaikuppam	-	-	-	-	-	-	100.00	-
Randam Korattur	-	-	-	-	-	-	100.00	-
Vedugasathu	-	-	-	-	-	-	100.00	-
Vettiyantholuvan	-	-	-	-	-	-	100.00	-
Rattinamanagalam	-	-	-	-	-	-	100.00	-
Chitheri	-	-	-	-	1.47	8.82	85.29	4.41
Velapadi	-	-	-	-	1.47	8.82	85.29	4.41
Kalleripattu	-	-	-	7.61	20.65	3.26	67.39	1.09
Mattathari	-	-	-	7.61	20.65	3.26	67.39	1.09
Ladavaram	-	-	-	-	1.92	1.92	96.15	-
Mamandur	-	-	-	-	-	-	100.00	-
Ladapadi	-	-	-	-	-	-	100.00	-
Katteri	-	-	-	-	-	-	100.00	-
Molugampoondi	-	-	-	6.25	53.13	18.75	21.88	-
Kalpoondi	-	-	-	6.25	53.13	18.75	21.88	-
Mullandram	-	-	-	-	0.85	9.32	89.83	-
Vedajipuram	-	-	-	-	0.85	9.32	89.83	-
Sathiyavijayanagaram	-	-	-	-	4.00	4.00	92.00	-
Nethapakkum	-	-	-	-	-	-	97.22	2.78

Gram Panchayat	Status of Physical condition of the soil (%)							
	Acidic Sulphate	Strongly Acidic	Highly Acidic	Moderately Acidic	Slighly Acidic	Neutral	Moderately Alkaline	Strongly Alkaline
Kanigiluppai	-	-	-	-	25.00	-	75.00	-
Pudupattu	-	-	-	-	11.76	-	88.24	-
Vilai	-	-	-	-	11.76	-	88.24	-
Nesal	-	-	-	-	1.52	7.58	90.91	-
Sirumur	-	-	-	-	1.95	1.30	96.75	-
Srinivasa Udayavanam	-	-	-	-	1.95	1.30	96.75	-
Velleri	-	-	-	-	2.38	-	97.62	-
Sangeethavadi	-	-	-	-	2.38	-	97.62	-
Paniyur	-	-	-	-	-	-	100.00	-
Ariyapadi	-	-	-	-	-	1.19	98.81	-
Savoor	-	-	-	-	1.52	7.58	90.91	-
Paiyur	-	-	-	-	-	-	100.00	-

Gram Panchayat	Soil Texture (%)				Soil moisture and ET			Means of Water Extraction (%)	
	% of Clay Soil	% of Fine Soil	% of Coarse loamy	Soil Water Permeability	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting
Adaiyapulam	-	74.00	-	Moderate	23.00	115	175	12.00	88.00
Adanur	-	71.00	-	Moderate	23.00	126	210	7.00	93.00
Agarapalayam	-	83.00	-	Moderate	23.00	124	258	3.00	97.00
Irumbedu	-	83.00	-	Moderate	23.00	148	118	6.00	94.00
Morappanthangal	-	91.00	-	Moderate	23.00	164	202	8.00	92.00
Meyyur	-	80.00	-	Moderate	23.00	96	228	3.00	97.00
Puthur	-	89.00	-	Moderate	23.00	181	134	11.00	89.00
Poosimalaikuppam	17.00	44.00	23.00	Moderate	23.00	78	112	2.00	98.00
Randam Korattur	-	80.00	-	Moderate	23.00	77	70	16.00	84.00
Vedugasathu	-	92.00	-	Moderate	23.00	161	107	12.00	88.00
Vettiyantholuvan	-	-	-	Moderate	23.00	249	153	11.00	89.00
Rattinamanagalam	-	77.00	-	Moderate	23.00	89	161	1.00	99.00
Chitheri	-	75.00	-	Moderate	23.00	609	101	1.00	99.00
Velapadi	6.00	77.00	-	Moderate	23.00	609	101	2.00	98.00
Kalleripattu	-	95.00	-	Moderate	23.00	609	101	2.00	98.00
Mattathari	-	82.00	-	Moderate	23.00	696	161	4.00	96.00
Ladavaram	-	79.00	-	Moderate	23.00	696	161	3.00	97.00
Mamandur	-	100.00	-	Moderate	23.00	814	169	2.00	98.00
Ladapadi	-	100.00	-	Moderate	23.00	814	169	2.00	98.00
Katteri	-	93.00	-	Moderate	23.00	814	169	2.00	98.00
Molugampoondi	13.00	83.00	-	Moderate	23.00	454	81	7.00	93.00
Kalpoondi	29.00	60.00	-	Moderate	23.00	454	81	7.00	93.00
Mullandram	9.00	68.00	12.00	Moderate	23.00	912	177	12.00	88.00
Vedajipuram	20.00	61.00	19.00	Moderate	23.00	912	177	-	100.00
Sathiyavijayanagaram	-	100.00	-	Moderate	23.00	527	67	2.00	98.00

Gram Panchayat	Soil Texture (%)				Soil moisture and ET			Means of Water Extraction (%)	
	% of Clay Soil	% of Fine Soil	% of Coarse loamy	Soil Water Permeability	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting
Nethapakkum	-	100.00	-	Moderate	23.00	527	67	2.00	98.00
Kanigiluppai	-	89.00	-	Moderate	23.00	527	67	3.00	97.00
Pudupattu	-	100.00	-	Moderate	23.00	771	70	6.00	94.00
Vilai	-	100.00	-	Moderate	23.00	771	70	1.00	99.00
Nesal	-	14.00	72.00	Moderate	23.00	771	70	6.00	94.00
Sirumur	5.00	83.00	-	Moderate	23.00	2,218	245	2.00	98.00
Srinivasa Udayavanam	7.00	66.00	26.00	Moderate	23.00	2,218	245	5.00	95.00
Velleri	-	80.00	-	Moderate	23.00	899	168	3.00	97.00
Sangeethavadi	-	100.00	-	Moderate	23.00	899	168	-	100.00
Paniyur	-	100.00	-	Moderate	23.00	233	219	4.00	96.00
Ariyapadi	0.40	94.00	-	Moderate	23.00	213	203	3.00	97.00
Savoor	-	100.00	-	Moderate	23.00	115	104	5.00	95.00
Paiyur	-	100.00	-	Moderate	23.00	76	67	-	100.00

Gram Panchayat	Irrigation Methods (%)		Livestock (No.)		
	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population
Adaiyapulam	-	100.00	520	60	211
Adanur	-	100.00	2,805	476	538
Agarapalayam	-	100.00	702	156	291
Irumbedu	21.00	79.00	820	325	672
Morappanthangal	36.00	64.00	825	393	273
Meyyur	-	100.00	563	356	199
Puthur	-	100.00	545	139	380
Poosimalaikuppam	16.00	84.00	661	2	406
Randam Korattur	100.00	-	343	134	94
Vedugasathu	100.00	-	1,527	703	171
Vettiyantholuvan	-	100.00	539	126	102
Rattinamanagalam	16.00	84.00	574	500	334
Chitheri	-	100.00	1,370	905	522
Velapadi	-	100.00	1,370	905	522
Kalleripattu	-	100.00	1,370	905	522
Mattathari	-	100.00	1,583	732	297
Ladavaram	-	100.00	1,583	732	297
Mamandur	-	100.00	845	1,743	186
Ladapadi	-	100.00	845	1,743	186
Katteri	-	100.00	845	1,743	186
Molugampoondi	-	100.00	917	651	425
Kalpoondi	-	100.00	917	651	425
Mullandram	-	100.00	967	113	413
Vedajipuram	-	100.00	967	113	413
Sathiyavijayanagaram	-	100.00	1,398	251	544
Nethapakkum	-	100.00	1,398	251	544
Kanigiluppai	-	100.00	1,398	251	544

Gram Panchayat	Irrigation Methods (%)		Livestock (No.)		
	Wild Flooding	Control Flooding	Cattle Population	Sheep Population	Goat Population
Pudupattu	-	100.00	1,496	1,453	174
Vilai	50.00	50.00	1,496	1,453	174
Nesal	50.00	50.00	1,496	1,453	174
Sirumur	17.00	83.00	1,702	183	677
Srinivasa Udayavanam	17.00	83.00	1,702	183	677
Velleri	-	100.00	4,045	556	250
Sangeethavadi	-	100.00	1,045	556	250
Paniyur	-	100.00	1,205	966	391
Ariyapadi	20.00	80.00	1,307	868	469
Savoor	-	100.00	621	768	209
Paiyur	-	100.00	1,205	966	391

ANNEXURE 3.8

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

Key CWRM Parameter\ GP	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable population (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)
Adaiyapulam	692	1,200	1,185	582	-	-	-	2,006	102	106	103
Adanur	755	2,060	1,946	4,006	614	8	622	950	99	56	86
Agarapalayam	690	1,728	1,715	3,443	381	21	402	832	98	45	82
Irumbedu	860	3,674	3,704	7,378	1,819	38	1,857	1,653	68	94	76
Morappanthangal	791	1,724	1,694	3,418	537	27	564	844	90	61	81
Meyyur	512	1,366	1,336	2,702	502	-	502	612	21	26	23
Puthur	831	1,044	964	2,008	911	6	917	460	109	21	83
Poosimalaikuppam	437	1,203	1,283	2,486	120	-	120	684	96	66	87
Randam Korattur	465	738	736	1,474	1,017	24	1,041	331	51	16	41
Vedugasathu	883	2,544	2,560	5,104	-	-	-	1,196	201	91	168
Vettiyantholuvan	1,187	796	864	1,660	325	13	338	413	11	17	13
Rattinamanagalam	478	2,222	2,159	4,381	394	36	430	947	29	53	36
Chitheri	338	1,686	1,685	3,371	671	-	671	2,006	102	106	103
Velapadi	394	1,765	1,840	3,605	205	-	205	2,006	102	106	103
Kalleripattu	193	839	840	1,679	1,055	-	1,055	2,006	102	106	103
Mattathari	391	870	852	1,722	867	-	867	883	176	70	144
Ladavaram	425	1,112	1,132	2,244	754	11	765	883	176	70	144
Mamandur	363	1,285	1,311	2,596	1,167	-	1,167	1,118	57	68	60
Ladapadi	201	379	373	752	350	-	350	1,118	57	68	60
Katteri	374	942	887	1,829	394	56	450	1,118	57	68	60
Molugampoondi	326	842	889	1,731	1,728	-	1,728	712	92	40	76
Kalpoondi	268	806	800	1,606	511	25	536	712	92	40	76
Mullandram	822	2,078	2,124	4,202	309	93	402	1,223	216	107	183
Vedajipuram	278	406	404	810	-	-	-	1,223	216	107	183

Key CWRM Parameter\ GP	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable population (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)
Sathiyavijayanagaram	126	2,946	2,948	5,894	33	10	43	1,422	252	81	201
Nethapakkum	95	619	661	1,280	1,106	-	1,106	585	37	37	37
Kanigiluppai	536	751	725	1,476	379	23	402	585	37	37	37
Pudupattu	93	805	812	1,617	782	-	782	1,083	284	73	221
Vilai	71	616	596	1,212	210	6	216	1,083	284	73	221
Nesal	411	872	868	1,740	594	-	594	1,083	284	73	221
Sirumur	353	1,398	1,485	2,883	864	31	895	1,317	207	73	167
Srinivasa Udayavanam	461	1,048	1,028	2,076	67	2	69	1,317	207	73	167
Velleri	411	783	789	1,572	25	-	25	880	222	52	171
Sangeethavadi	602	1,134	1,030	2,164	514	19	533	880	222	52	171
Paniyur	652	3,723	3,832	7,555	2,015	61	2,076	844	90	61	81
Ariyapadi	1,104	531	518	1,049	145	-	145	844	90	61	81
Savoor	640	5,213	5,086	10,299	1,032	-	1,032	2,170	40	72	50
Paiyur	381	3,723	3,832	7,555	2,015	-	2,015	950	99	56	86

Key CWRM Parameter\GP	% of Vulnerable House-holds	Registered MGNRE-GA Job cards (No.)	Active per-son working in MGN-REGA job Cards (No.)	Drinking Water Sources (No.)	Ground Water - Drinking source (No.)	Surface wa-ter - Drink-ing source (No.)	sum of 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)
Adaiyapulam	0	891	660	20	3	-	3	185	-	1
Adanur	0	1,523	1,109	350	3	1	4	-	325	7
Agarapalayam	0	1,204	805	220	3	-	3	-	412	6
Irumbedu	0	2,197	1,816	190	3	-	3	-	325	13
Morappanthangal	0	1,289	1,005	193	3	1	4	-	325	6
Meyyur	0	983	735	190	3	-	3	-	325	5
Puthur	0	705	616	573	3	-	3	45	474	4
Poosimalaikuppam	0	844	673	165	4	1	5	434	414	5
Randam Korattur	0	459	409	573	3	-	3	45	474	3
Vedugasathu	0	1,760	1,510	162	4	-	4	434	414	9
Vettiyantholuvan	0	458	376	573	3	-	3	45	474	3
Rattinamanagalam	0	918	849	576	3	1	4	45	474	8
Chitheri	0	1,328	1,033	709	5	1	6	-	-	6
Velapadi	0	1,891	807	802	4	1	5	-	-	7
Kalleripattu	0	882	592	489	4	1	5	-	-	3
Mattathari	0	647	439	430	4	1	5	-	-	3
Ladavaram	0	1,140	715	710	4	1	5	-	-	4
Mamandur	0	728	648	583	4	1	5	-	-	5
Ladapadi	0	371	213	202	4	1	5	-	-	1
Katteri	0	595	497	451	4	1	5	-	-	3
Molugampoondi	0	423	314	514	5	-	5	-	-	3
Kalpoondi	0	787	483	473	4	1	5	1,827	-	3
Mullandram	0	1,489	960	1,054	4	1	5	-	-	8
Vedajipuram	0	535	313	324	4	1	5	-	-	1
Sathiyavijayanagaram	0	967	865	2,061	5	1	6	-	-	11

Key CWRM Parameter\GP	% of Vulnerable House-holds	Registered MGNRE-GA Job cards (No.)	Active per-son working in MGN-REGA job Cards (No.)	Drinking Water Sources (No.)	Ground Water - Drinking source (No.)	Surface wa-ter - Drink-ing source (No.)	sum of 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)
Nethapakkum	0	344	294	284	4	1	5	-	-	2
Kanigiluppai	0	669	546	433	4	1	5	-	-	3
Pudupattu	0	934	625	524	5	1	6	-	-	3
Vilai	0	550	393	303	4	1	5	-	-	2
Nesal	0	644	564	434	5	1	6	-	-	3
Sirumur	0	1,101	795	806	4	1	5	-	-	5
Srinivasa Udayavanam	0	870	700	586	4	1	5	-	-	4
Velleri	0	449	318	444	4	1	5	-	-	3
Sangeethavadi	0	1,080	668	515	4	1	5	-	-	4
Paniyur	0	1,188	983	1,787	4	1	5	-	-	14
Ariyapadi	0	1,112	990	1,263	4	1	5	-	-	2
Savoor	0	1,948	1,596	3,244	3	1	4	-	-	19
Paiyur	0	2,202	1,295	1,791	4	1	5	-	-	14

ANNEXURE 4

IPCC VULNERABILITY ASSESSMENT METHODOLOGY

Normalization of Indicators:

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

- for indicators with positive relationship with vulnerability

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

- for indicators with negative relationship with vulnerability

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

Aggregation and categorization of Indicators

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

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

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

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

ANNEXURE 5.1

GP WISE WASCA PROPOSED TREATMENT AREA

Key CWRM Parameter	Treatment Area under Non-Agricultural Uses	Treatment Area under Barren & Un-cultivable Land	Treatement Area under Permanent Pastures and Other Grazing Land	Treatment Area under Land Under Miscellaneous Tree Criticalops etc.	Treatment Area under Culturable Waste Land	Treatment Area under Fallows Land other than Current Fallows	Treatment Area under Current Fallow land	Treatment Area under Unirrigated Land	Treatment Area Irrigated by Source
Adaiyapulam	14.52	122.99	-	-	1.55	-	-	7.79	18.3
Adanur	15.57	108.58	-	-	-	-	12.89	3.63	22.05
Agarapalayam	76.38	160.16	-	-	1.98	-	-	15.71	16.19
Irumbedu	10.81	176.88	-	-	9.08	0.29	11.12	0.26	14.12
Morappanthangal	-	226.18	-	-	-	-	15.92	14.17	11.01
Meyyur	46.99	71.36	-	-	-	0.77	0.7	2.64	21.17
Puthur	-	257.86	-	-	25.19	-	43.57	13.2	9.37
Poosimalaikuppam	1.95	60.09	-	-	-	-	15.73	4.65	13.53
Randam Korattur	11.11	184.76	-	-	-	-	-	2.17	6.87
Vedugasathu	91.94	-	-	-	-	35.05	44.56	0.91	12.62
Vettiyantholuvan	-	-	-	-	-	0.1	27.61	1.85	13.02
Rattinamanagalam	46.19	137.88	-	-	-	-	0.05	0.65	7.36
Chitheri	5.14	-	-	-	-	15.43	5.91	0.02	19.36
Velapadi	5.14	-	-	-	-	15.43	5.91	0.02	19.36
Kalleripattu	5.14	-	-	-	-	15.43	5.91	0.02	19.36
Mattathari	12.97	280.31	-	-	-	-	2.29	16.3	20.58
Ladavaram	12.97	280.31	-	-	-	-	2.29	16.3	20.58
Mamandur	-	311.66	-	-	-	-	4.03	4.03	24.9
Ladapadi	-	311.66	-	-	-	-	4.03	4.03	24.9
Katteri	-	311.66	-	-	-	-	4.03	4.03	24.9
Molugampoondi	12.92	205.83	-	-	-	-	2.69	9.89	6.21

Key CWRM Parameter	Treatment Area under Non-Agricultural Uses	Treatment Area under Barren & Un-cultivable Land	Treatement Area under Permanent Pastures and Other Grazing Land	Treatment Area under Land Under Miscellaneous Tree Criticalops etc.	Treatment Area under Culturable Waste Land	Treatment Area under Fallows Land other than Current Fallows	Treatment Area under Current Fallow land	Treatment Area under Unirrigated Land	Treatment Area Irrigated by Source
Kalpoondi	12.92	205.83	-	-	-	-	2.69	9.89	6.21
Mullandram	6.73	418.34	-	-	-	-	2.19	18.51	21.61
Vedajipuram	6.73	418.34	-	-	-	-	2.19	18.51	21.61
Sathiyavijayanagaram	21.63	299.24	-	-	0.32	-	-	1.12	11.97
Nethapakkum	21.63	299.24	-	-	0.32	-	-	0.5	11.97
Kanigiluppai	6.69	299.24	-	-	0.32	-	-	0.5	11.97
Pudupattu	3.04	205.28	0.17	-	127.5	-	39.52	2.24	12.25
Vilai	3.04	205.28	0.17	-	127.5	-	39.52	2.24	12.25
Nesal	3.04	205.28	0.17	-	127.5	-	39.52	2.24	12.25
Sirumur	-	235.7	10.77	-	1.01	-	181.59	20.96	28.86
Srinivasa Udayavanam	-	235.7	10.77	-	1.01	-	181.59	20.96	28.86
Velleri	-	432.47	-	-	-	-	-	14.03	24.97
Sangeethavadi	-	432.47	-	-	-	-	-	14.03	24.97
Paniyur	16.03	266.96	16.38	2.11	5.08	-	22.14	11.27	27.79
Ariyapadi	21.37	121.67	-	-	-	50	43.79	21.74	30.21
Savoor	70.68	204.57	-	-	-	-	0.59	-	20
Paiyur	-	88.5	0.05	-	30.92	2.64	1.09	-	12.84

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

ANNEXURE 5.2

GP WISE EXPECTED RUNOFF CONSERVATION AFTER WASCA TREATMENT

GP\ Run Off Conserved (Exisiting)	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Adaiyapulam	52.01	0.44	4.88
Adanur	49.83	-	7.21
Agarapalayam	88.02	0.56	5.97
Irumbedu	73.55	2.55	4.82
Morappanthangal	93.83	-	8.05
Meyyur	45.41	-	4.73
Puthur	94.59	7.08	12.37
Poosimalaikuppam	28.30	-	6.64
Randam Korattur	73.81	-	1.69
Vedugasathu	36.71	-	17.42
Vettiyantholuvan	4.24	-	7.96
Rattinamanagalam	74.06	-	1.58
Chitheri	2.60	-	7.60
Velapadi	5.01	4.34	13.31
Kalleripattu	2.90	-	7.60
Mattathari	106.11	-	0.00
Ladavaram	105.29	-	0.00
Mamandur	112.62	-	70.61
Ladapadi	113.75	-	70.61
Katteri	112.64	-	70.61
Molugampoondi	80.96	-	0.00
Kalpoondi	79.67	-	0.00
Mullandram	154.99	-	0.00
Vedajipuram	153.12	-	0.00
Sathiyavijayanagaram	115.49	0.09	0.00
Nethapakkum	116.89	0.09	0.00
Kanigiluppai	111.00	0.09	0.00
Pudupattu	77.69	-	0.00
Vilai	76.40	-	0.00
Nesal	76.36	-	0.00
Sirumur	92.72	0.28	132.83
Srinivasa Udayavanam	90.30	0.28	132.83
Velleri	158.43	-	30.45
Sangeethavadi	157.45	-	30.45
Paniyur	106.59	6.62	11.44
Ariyapadi	57.50	-	22.60
Savoor	101.17	-	3.85
Paiyur	38.34	9.43	28.05

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.	Area	Length	No.	No.	Area	No.	Area	No.
Adaiyapulam	99,630	125	-	-	-	13	8,712	11	-	-	13
Adanur	86,862	109	-	-	-	68	9,343	12	-	-	68
Agarapalayam	129,708	162	-	-	-	35	2,016	3	273	1,364	35
Ariyapadi	97,332	122	-	-	-	33	17,094	21	504	2,520	33
Chitheri	-	-	52	131	-	34	16,800	21	444	2,220	34
Irumbedu	148,764	186	-	-	-	19	6,486	8	685	3,425	19
Kalleripattu	-	-	-	-	-	34	2,332	3	860	4,300	34
Kalpoondi	164,664	206				23	2,346	3	540	2,700	23
Kanigiluppai	3,040	4	-	-	-	35	41,280	52	-	-	35
Katteri	249,324	312	-	-	-	21	1,610	2	400	2,000	21
Ladapadi	249,324	312	46	115	-	21	1,610	2	490	2,450	21
Ladavaram	224,244	280	-	-	-	40	10,400	13	450	2,250	40
Mamandur	249,324	312				21	1,610	2	500	2,500	21
Mattathari	224,244	280				40	10,400	13	860	4,300	40
Meyyur	57,090	71	-	-	-	10	28,194	35	187	933	10
Molugampoond	164,664	206	-	-	-	23	2,346	3	820	4,100	23
Morappanthangal	-	-	-	-	-	81	180,942	226	850	-	81
Mullandram	334,668	418	-	-	-	24	3,057	4	-	-	24
Nesal	266,226	333				37	1,379	2	680	3,400	37
Nethapakkum	239,640	300	-	-	-	35	3,037	4	386	1,930	35
paiyur	95,541	119	-	-	-	30	4,800	6	560	2,800	30
Panaiyur	217,632	272	-	-	-	58	9,617	12	519	2,594	58
Poosimalaikuppam	1,562	2	-	-	-	87	48,072	60	1,458	7,290	87
Pudupattu	2,400	3	-	-	-	44	640	1	-	-	37
Puthur	226,434	283	-	-	-	49	-	-	-	-	49

Gram Panchayat	Aff		ARS		AVP	AZ	BP		CBP		CS
	No.	Area	No.	Area	Length	No.	No.	Area	No.	Area	No.
Randam Korattur	147,810	185	-	-	-	21	6,667	8	-	-	21
Rattinamanagalam	36,948	46	-	-	-	36	110,304	138	908	-	36
Sangeethavadi	-	-	-	-	-	26	-	-	420	2,100	26
Sathiyavijayanagaram	-	-	-	-	300	35	4,000	5	-	-	35
savoor	163,659	205	-	-	-	28	1,781	2	-	-	28
Sirumur	189,372	237				43	1,504	2	820	4,100	43
Srinivasa udayavanam	189,372	237	-	-	-	43	1,504	2	440	2,200	43
Vedajipuram	334,668	418	-	-	-	24	3,057	4	640	3,200	24
Vedugasathu	-	-	-	-	-	107	55,164	69	138	690	107
Velapadi	-	-				34	16,800	21	432	2,160	34
Velleri	345,978	432				26	1,544	2	336	1,680	26
Vettiyantholuvam	-	-	-	-	-	8	-	-	412	2,061	8
Vilai	266,226	333	-	-	-	37	1,379	2	310	1,550	37

Gram Panchayat	CT	Co		FP	COWRS	CCB		DLT		DLHA		FBBT	
	No.	No.	Area	No.	No.	No.	Length	No.	Length	No.	Area	No.	Area
Adaiyapulam	13	9	-	13	73	-	-	909	4,545			2	5
Adanur	68	12	-	17	88	-	-	1,164	5,819			3	8
Agarapalayam	35	10	-	13	65	-	-	1,313	6,563			4	10
Ariyapadi	33	6	146	10	-	-	-	504	2,520	70,376	88	18	46
Chitheri	34	6	61	10	-	-	-	444	2,220	32,106	40	17	42
Irumbedu	19	8	-	12	46	-	-	644	3,220			6	15
Kalleripattu	34	6	58	10	-	-	-	860	4,300	23,386	29	16	40
Kalpoondi	23	6	19	10	-	-	-	540	2,700	7,696	10	5	13
Kanigiluppai	35	3	-	5	-	-	-	420	2,100	304	-	-	1
Katteri	21	6	21	10	-	-	-	400	2,000	8,597	11	3	8
Ladapadi	21	6	21	10	-	-	-	490	2,450	8,597	11	3	8
Ladavaram	40	6	39	10	-	-	-	450	2,250	23,904	30	8	19
Mamandur	21	6	21	10	-	-	-	500	2,500	8,597	11	3	8
Mattathari	40	6	39	10	-	-	-	860	4,300	23,904	30	8	19
Meyyur	10	9	-	15	85	-	-	52	260			1	2
Molugampoond	23	6	19	10	-	-	-	820	4,100	7,696	10	5	13
Morappanthangal	81	12	-	57	28	48,272	267	-	-	4,110	21	6	15
Mullandram	24	6	53	10	-	-	-	-	-	21,233	27	8	21
Nesal	37	6	67	10	-	-	-	680	3,400	26,689	33	68	169
Nethapakkum	35	6	8	10	-	-	-	386	1,930	3,229	4	-	1
paiyur	30	6	23	10	-	-	-	560	2,800	14,391	18	16	41
Panaiyur	58	18	-	25	111	-	-	1,174	5,871			9	22
Poosimalaikuppam	87	8	-	21	42	14,488	96	-	-	3,391	17	4	10
Pudupattu	37	10	-	7	20	-	-	-	-	6,400	8		
Puthur	49	15	-	21	37	-	-	744	3,718			21	54
Randam Korattur	21	3	-	7	27	-	-	411	2,056			-	1
Rattinamanagalam	36	2	-	39	74	36,956	192	-	-	806	4	-	0

Gram Panchayat	CT	Co		FP	COWRS	CCB		DLT		DLHA		FBBT	
	No.	No.	Area	No.	No.	No.	Length	No.	Length	No.	Area	No.	Area
Sangeethavadi	26	6	-	10	-	-	-	420	2,100	-	-	-	-
Sathiyavijayanagaram	35	3	17	2	48	-	-	-	0	800	1	-	1
savoor	28	8	-	11	80	-	-	245	1,227			-	1
Sirumur	43	6	139	10	-	-	-	820	4,100	55,504	69	48	119
Srinivasa udayavanam	43	6	239	10	-	-	-	440	2,200	95,641	120	81	204
Vedajipuram	24	6	53	10	-	-	-	640	3,200	21,233	27	8	21
Vedugasathu	107	21	-	24	50	-	-	953	4,764			21	40
Velapadi	34	6	61	10	-	-	-	432	2,160	32,106	40	17	42
Velleri	26	6	63	10	-	-	-	336	1,680	25,019	31	6	14
Vettiyantholuvam	8	11	-	11	52	-	-	-	-			6	15
Vilai	37	6	67	10	-	-	-	310	1,550	26,689	33	68	169

Gram Panchayat	FD	GSS	ICP		LD		LP		MI		NADEP
	Area	No.	No.	Length	No.	Area	No.	Length	No.	Area	No.
Adaiyapulam		3	-	-	63	158	545	2,725	-	-	13
Adanur		23	-	-	60	151	3,756	18,780	-	-	68
Agarapalayam		11	-	-	75	189	341	1,705	-	-	35
Ariyapadi	-	48	-	-	49	122	-	-	12	30	33
Chitheri	-		-	-	-	-	-	-	8	19	34
Irumbedu			-	-	86	214	840	4,200	-	-	19
Kalleripattu	-	50	-	-	8	20	-	-	7	19	34
Kalpoondi		37	-	-	3	6	-	-	3	7	23
Kanigiluppai		6	269	1,350	-	-	1,005	5,048	-	-	35
Katteri	-	89	-	-	2	4	-	-	5	13	21
Ladapadi	-	89	-	-	2	4	-	-	5	13	21
Ladavaram	-	40	-	-	112	280	-	-	8	21	40
Mamandur		89	-	-	2	4	-	-	5	13	21
Mattathari		40	-	-	112	280	-	-	8	21	40
Meyyur			-	-	52	130	701	3,505	-	-	10
Molugampoond	-	37	-	-	3	6	-	-	3	7	23
Morappanthangal	810			-	6	15	932	4,661	-	-	81
Mullandram	-	10	-	-	4	10	-	-	13	32	24
Nesal		75	-	-	8	21	-	-	10	25	37
Nethapakkum	-	18	-	-	-	-	-	-	3	8	35
paiyur	-	52	-	-	48	119	-	-	5	13	30
Panaiyur		33	-	-	139	347	1,698	8,490	-	-	58
Poosimalaikuppam	870		2,210	11,050	4	10	397	1,985	-	-	87
Pudupattu		9	234	1,174	2	4	26	134	-	-	37
Puthur		23	-	-	128	321	903	4,515	-	-	49
Randam Korattur		7	-	-	80	201	736	3,680	-	-	21
Rattinamanagalam	360		1,518	7,590	-	0	483	2,415	-	-	36

Gram Panchayat	FD	GSS	ICP		LD		LP		MI		NADEP
	Area	No.	No.	Length	No.	Area	No.	Length	No.	Area	No.
Sangeethavadi	-	31	-	-	-	-	-	-	-	-	26
Sathiyavijayanagaram	-	6	-	-	-	1	523	2,615	-	16	35
savoor		22	-	-	91	228	-	-	-	-	28
Sirumur		16	-	-	24	59	-	-	8	21	43
Srinivasa udayavanam	-	16	-	-	41	101	-	-	15	37	43
Vedajipuram	-	10	-	-	4	10	-	-	13	32	24
Vedugasathu		31	-	-	49	122	793	3,965	-	-	107
Velapadi		50	-	-	-	-	-	-	8	19	34
Velleri		31	-	-	3	7	-	-	19	49	26
Vettiyantholuvam		2	-	-	11	28	399	1,995	-	-	8
Vilai	-	75	-	-	8	21	-	-	10	25	37

Gram Panchayat	ND		RWBT	RWBO	RWBP	RRWH	SPD		SP	SPI	WCICD	
	No.	Area	No.	No.	No.	No.	No.	Area	No.	No.	No.	Length
Adaiyapulam	2,006	401	4	1	6	2	-	-	20	103	-	-
Adanur	950	190	3	2	6	2	-	-	10	86	-	-
Agarapalayam	832	166	1	-	3	2	-	-	8	82	-	-
Ariyapadi	6,225	1,245	1	-	3	2	-	-	12	125	-	-
Chitheri	4,840	968	1	-	1	2	-	-	10	97	-	-
Irumbedu	1,653	331	4	-	4	2	-	-	17	76	-	-
Kalleripattu	2,700	540	3		2	2	-	-	5	54	-	-
Kalpoondi	2,255	451	2	-	2	2	-	-	5	45	-	-
Kanigiluppai	175	35	7	-	3	2	-	-	2	134	269	1,350
Katteri	2,195	439	4	-	1	2	-	-	4	44	-	-
Ladapadi	950	190	1	-	2	2	-	-	2	19	-	-
Ladavaram	2,750	550	2		3	2	-	-	6	55	-	-
Mamandur	2,780	556	2	-	4	2	-	-	6	56	-	-
Mattathari	2,100	420	2		3	2	-	-	4	42	-	-
Meyyur	612	122	4	-	2	2	-	-	6	23	-	-
Molugampoond	2,435	487	2		1	2	-	-	5	49	-	-
Morappanthangal	4,220	844	4	-	5	2	-	-	16			-
Mullandram	5,165	1,033	2	-	4	2	-	-	10	103	-	-
Nesal	407	81	2	-	4	2	132	-	4	41	-	-
Nethapakkum	1,445	289	2	-	-	2	-	-	3	29	-	-
paiyur	8,820	1,764	2	-	3	2	33,600	42	18	176	-	-
Panaiyur	844	169	6		2	2	13,104	16	8	81	-	-
Poosimalaikuppam	3,420	684	1	-	4	2	-	-	15		2,210	11,050
Pudupattu	220	44	-	-	1	2	-	-	2	50	234	1,174
Puthur	460	92	2	-	6	2	-	-	5	83	-	-
Randam Korattur	331	66	3	-	3	2	-	-	3	41	-	-
Rattinamanagalam	4,735	947	1	-	2	2	-	-	9		1,518	7,590

Gram Panchayat	ND		RWBT	RWBO	RWBP	RRWH	SPD		SP	SPI	WCICD	
	No.	Area	No.	No.	No.	No.	No.	Area	No.	No.	No.	Length
Sangeethavadi	2,455	491	4	-	6	2	-	-	5	49	-	-
Sathiyavijayanagaram	-	-	-	-	3	2	-	-	3	376	-	-
savoor	950	190	3	-	3	2	-	-	10	86	-	-
Sirumur	3,890	778	2	-	1	2	8,616	11	8	78	-	-
Srinivasa udayavanam	2,810	562	2	-	-	2	8,616	11	6	56	-	-
Vedajipuram	1,545	309	1	-	2	2	-	-	3	31	-	-
Vedugasathu	1,196	239	4	-	2	2	-	-	12	168	-	-
Velapadi	4,315	863	7		2	2	-	-	9	86	-	-
Velleri	2,125	425	2	-	2	2	-	-	4	43	-	-
Vettiyantholuvam	413	83			1	2	-	-	4	13	-	-
Vilai	1,435	287	-	-	1	2	132	0	3	29	-	-

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

S. No	GP	WASCA Recommendation for 3 Years	Works uploaded for FY-2021-22 as on 02/02/2022
1	Adanur	702	169
2	Adayapulam	461	269
3	Agrapalayam	533	13
4	Ariyapadi	353	451
5	Chitteri	380	253
6	Irumbedu	433	238
7	Kalleripattu	805	253
8	Kalpoondi	317	191
9	Kanigiluppai	343	202
10	Katteri	482	167
11	Ladapadi	459	147
12	Ladavaram	599	182
13	Mamandur	570	172
14	Mattathari	385	124
15	Meyyur	374	158
16	Molugampoondi	505	188
17	Morappanthangal	850	589
18	Mullandram	981	831
19	Nesal	451	187
20	Nethapakkam	119	197
21	Paiyur	559	347
22	Panaiyur	837	353
23	Poosimalaikuppam	839	100
24	Pudupattu	1204	243
25	Puthur	575	94
26	Randamkorattur	328	120
27	Rattinamangalam	491	254
28	S.U.Vanam	1105	383
29	S.V.Nagaram	912	277
30	Sangeethavadi	1015	313
31	Sevur	445	353
32	Sirumur	1082	14
33	Vadugasathu	867	211
34	Vedajipuram	876	79
35	Velappadi	935	218
36	Velleri	589	206
37	Vettiyantholuvam	230	103
38	Vilai	160	79

ANNEXURE 7.2

GP AND WORK CATEGORY -WISE ONGOING WORKS IN ARNI BLOCK

GP	Work Category	No. Ongoing works
Puthur	Water Conservation and Water Harvesting	2
Adanur	Water Conservation and Water Harvesting	2
Adayapulam	Water Conservation and Water Harvesting	2
Agrapalayam	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Ariyapadi	Water Conservation and Water Harvesting	2
Chitteri	Water Conservation and Water Harvesting	2
Irumbedu	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Kalleripattu	Rural Sanitation	4
	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	3
Kalpoondi	Water Conservation and Water Harvesting	2
Kangiluppai	Water Conservation and Water Harvesting	2
Katteri	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Ladapadi	Water Conservation and Water Harvesting	1
Ladavaram	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Mamandur	Water Conservation and Water Harvesting	2
Mattathari	Water Conservation and Water Harvesting	2
Meyyur	Water Conservation and Water Harvesting	2
Molugamboondi	Water Conservation and Water Harvesting	1
Morappanthangal	Water Conservation and Water Harvesting	2
Mullandram	Water Conservation and Water Harvesting	3
	Works on Individuals Land (Category IV)	1
Nesal	Water Conservation and Water Harvesting	2
Nethapakkam	Water Conservation and Water Harvesting	1
Paiyur	Water Conservation and Water Harvesting	2
Panaiyur	Drought Proofing	1
	Land Development	1
	Water Conservation and Water Harvesting	2
Poosimalaikuppam	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	6
Pudupattu	Water Conservation and Water Harvesting	2
Randamkorattur	Anganwadi/Other Rural Infrastructure	3
	Water Conservation and Water Harvesting	2
Rattinamangalam	Water Conservation and Water Harvesting	2
S.U.Vanam	Water Conservation and Water Harvesting	2

GP	Work Category	No. Ongoing works
S.V.Nagaram	Water Conservation and Water Harvesting	2
Sangeethavadi	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Sevur	Rural Sanitation	1
	Water Conservation and Water Harvesting	2
Sirumur	Water Conservation and Water Harvesting	2
Vadugasathu	Water Conservation and Water Harvesting	2
Vedajipuram	Water Conservation and Water Harvesting	2
Velappadi	Water Conservation and Water Harvesting	2
Velleri	Water Conservation and Water Harvesting	1
Vettiyantholuvam	Water Conservation and Water Harvesting	1
Vilai	Water Conservation and Water Harvesting	1

ANNEXURE 8

KEY CWRM PARAMETERS FOR THE GPs FALLING UNDER POOSIMALAIKUPPAM AND MULLANDRAM GP MICRO-WATERSHED

CWRM Parameter	Poosimalaikuppam	Mullandram
Soil Resources: Status of Available Nitrogen (%)		
Very Low	22.79	10.05
Low	70.59	73.68
Medium	6.62	16.27
Status of Organic Carbon (%)		
Very Low	53.42	26.79
Low	46.58	66.99
Medium	0.00	6.22
Status of Soil Micro Nutrients (%)		
Sufficient	42.00	56.00
Deficient	58.00	44.00
Status of Physical condition of the soil (%)		
Slighly Acidic	-	0.85
Neutral	-	9.32
Moderately Alkaline	100.00	89.83
Moderately Alkaline	100.00	100.00
Soil Texture (%)		
% of Clay Soil	17.00	9.00
% of Fine Soil	44.00	68.00
% of Coarse loamy	23.00	12.00
Soil Water Permeability	Moderate	Moderate
Soil moisture and ET		
Volumetric Soil Moisture (%)	23.00	23.00
Estimated Soil Moisture (ha.m)	78.42	911.96
ET Losses (ha.m)	112.45	177.26
Means of Water Extraction (%)		
Gravity	2	12
Lifting	98	88
Irrigation Methods (%)		
Wild Flooding	16	0
Control Flooding	84	100
Livestock (No.)		
Cattle Population	661.00	967.00
Sheep Population	2.00	113.00
Goat Population	406.00	413.00
Land Resources (ha)		
Area under Non-Agricultural Uses	96.32	224.48
Area under Barren & Un-cultivable Land	80.12	557.78
Area under Current Fallow land	120.98	14.60
Area under Unirrigated Land	35.77	123.51
Area Irrigated by Source	104.09	216.07

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