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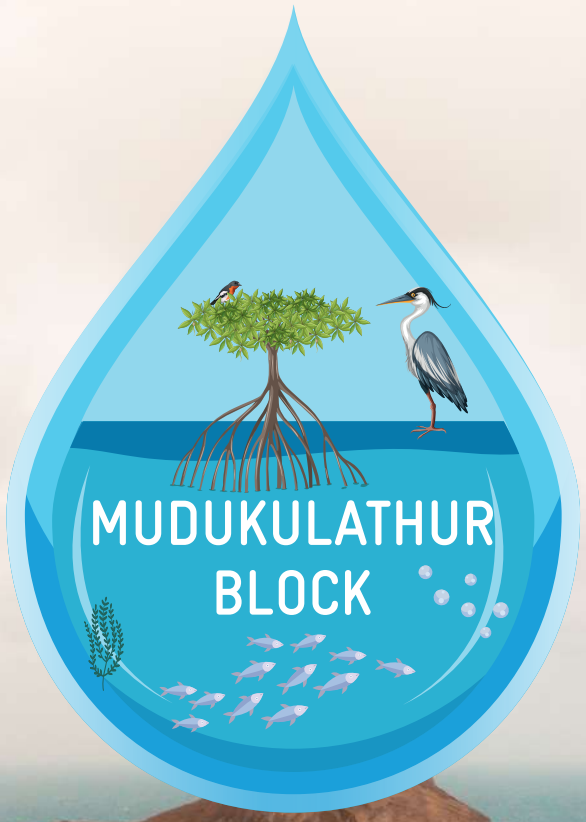
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



SUSTAINABLE DEVELOPMENT GOALS

Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

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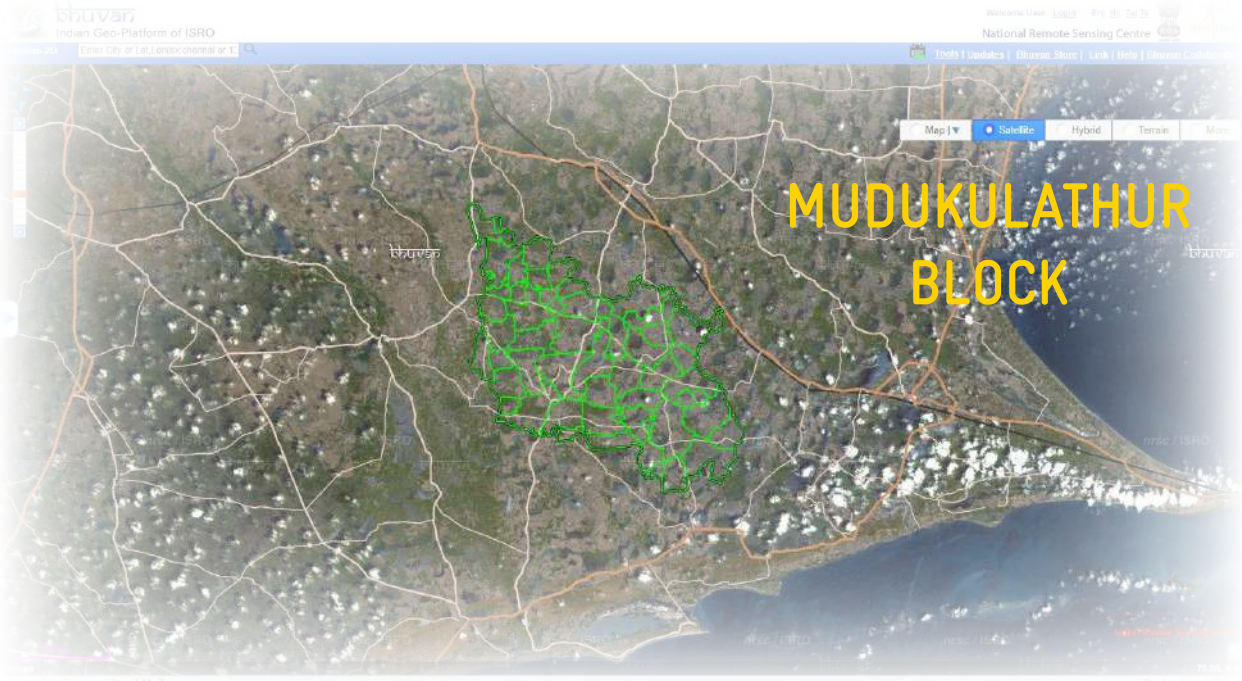
WATER SECURITY AND CLIMATE ADAPTATION IN RURAL INDIA



Block Level Composite Water Resources Management Plan under Mahatma Gandhi NREGS

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

FOREWORD

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

FOREWORD

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

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

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

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

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

The Block report focuses on sustainable water resource management, as it is the true driver for all development in a natural resource dependent rural livelihood scenario. The climate actions initiated not through

separate climate funds, but by leveraging existing public programmes and schemes, such as Mahatma Gandhi NREGA, to act now and decisively.

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

We look forward to its success!

Rajeev Ahal
Director,
NRM & Agroecology, GIZ India

MESSAGES

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

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

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

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

Through District level GIS resource centres, GIZ with the partners MSSRF build capacity of Block, GP level technical officers of Rural Development Department in completion of 1,289 GP plans. In preparation of GP level plans, Nationally approved Comprehensive Water Resources Management (CWRMP) 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 - G

DLSC
District Level Steering Committee

DLT
Drainage Line Treatment

DRD&PR
Department of Rural Development & Panchayat Raj

EC
End Century

ET
Evapo-transpiration

FPO
Farmer Producer Organization

FY
Financial Year

GIS
Geographical Information System

GIZ
Deutsche Gesellschaft für Internationale

Govt.
Government

GP
Gram Panchayat

GW
Ground Water

H - K

ha
Hectare

ha.m
Hectare Meter

HH
Households

ICAR
Indian Council for Agriculture Research

IMD
Indian Meteorological Department

INR
Indian Rupees

IPCC
Intergovernmental Panel on Climate Change

IWRM
Integrated Water Resources Management

Kharif crop
Sown in Monsoon and harvested close to Autumn

km
Kilometer

KML
Keyhole Markup Language

L - M

LULC
Land use and land cover

Max
Maximum

MCM
Million Cubic Meter

MC
Mid Century

Mahatma Gandhi NREGA
Mahatma Gandhi Rural Employment Guarantee Act

Mahatma Gandhi NRGES
Mahatma Gandhi Rural Employment Guarantee Scheme

Min
Minimum

mm
Millimeter

MoEFCC
Ministry of Environment, Forest and Climate Change

MoJS
Ministry of Jal Shakti

MoRD
Ministry of Rural Development

m
Meters

N - P

NAPCC
National Action on Climate Change

NARP
National Agricultural Research Project

NADEP
Nadepkaka

NDC
Nationally Determined Contributions

NEM
North-East monsoon

NGO
Non-Governmental Organization

NITI
National Institution for Transforming India

No.
Number

NRM
Natural Resource Management

NRSC
National Remote Sensing Centre

NWC
National Water Commission

PWD
Public Works Department

R - S

Rabi crop
Sown in winter and harvested in monsoon

RDPR
Rural Development & Panchayat Raj

RF
Reserve Forest

RTRWHS
Roof top rain water harvesting structures

RWHS
Rain Water Harvesting System

SAPCC
State Action Plan on Climate Change

SC
Scheduled Caste

SDG
Sustainable Development Goal

SDMA
State Disaster Management Authority

SDMRI
Suganthi Devadasan Marine Resources Institute

SECC
Socio Economic and Caste Census

S - W

SHG
Self Help Group

SLSC
State Level Steering Committee

ST
Scheduled Tribe

SWM
South-West monsoon

SW
Surface Water

TN
Tamil Nadu

UN
United Nations

WASCA
Water Security and Climate Adaptation

WCWH
Water Conservation and Water Harvesting

வான்நின்று உலகம் வழங்கி வருதலால்
தான்அமிழ்தம் என்றுணரற் பாற்று

குறள் - 11

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

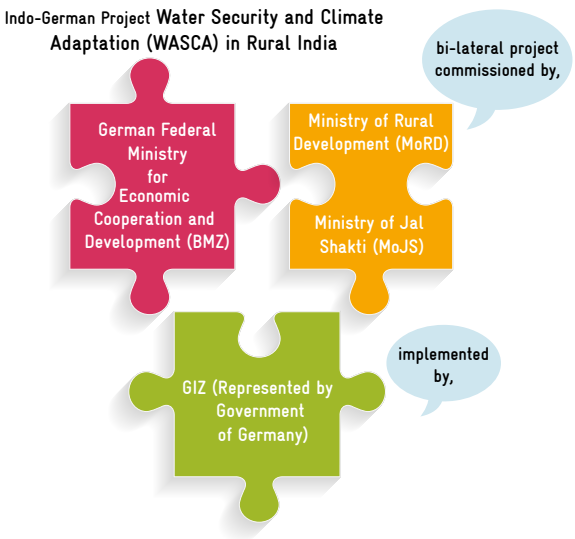
Thirukkural - 11

EXECUTIVE SUMMARY

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

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

The Indo-German Project "Water Security and Climate Adaptation in Rural India" (WASCA), is a bi-lateral project commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) in partnership with the Ministry of Rural Development (MoRD) and Ministry of Jal Shakti (MoJS) and implemented by GIZ (Represented by Government of Germany). This project aims to improve water resource management with respect to water security and climate adaptation with an effort to establish a framework for integrating water perspectives into planning and implementing adaptation actions that promotes climate resilience. It is implemented under technical cooperation from BMZ-GIZ with implementation under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA/S) and National Water Mission (Catch the Rain Campaign) under MoRD, MoJS respectively. In Tamil Nadu State, the project is jointly implemented by the Department of Rural Development & Panchayat Raj, (DRD&PR) Government of Tamil Nadu, Chennai and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.



Initially WASCA Tamil Nadu conducted a preliminary state level scoping study on the State's Rural Water Security using the 18 vulnerable indicators, which covered four important and interconnected parameters/areas of Climate extremities, water resource, agriculture and socio-economic at the District level. Based on the outcomes of the assessment, Tiruvannamalai and Ramanathapuram districts were given priority by the State Level Steering Committee headed by the Additional Chief Secretary, RD&PR in November 2019 for implementing the WASCA. These 18 indicators were further studied at the Gram Panchayat (GP) level integrating the Composite Water Resource Management (CWRM) and MGNREGA/S approach to identify the key problems and propose key actions for implementation in each district.

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

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

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

This report is structured with nine complete chapters

1

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

2

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

3

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

4

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

5

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

6

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

7

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

8

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

9

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

துப்பார்க்குத் துப்பாய துப்பாக்கித் துப்பார்க்குத்
துப்பாய தூஉம் மழை

குறள் - 12

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

Thirukkural - 12

CHAPTER 1

1 ABOUT THE BLOCK

Mudukulathur Blocks of Ramanathapuram District lies between 9°16'16.507"N to 9°33'0.449"N latitude and 78°26'13.193"E to 78°40'33.226"E longitude. This Block has long coastal stretch in the east side along the Bay of Bengal and surrounded by Bogalur, Thiruppullani, Kadaladi, Kamuthi and Paramakudi Blocks (Figure 1.1). The total geographical area of Block is 43,170 ha (431.70 Km²). The Block has 46 Gram Panchayats with 169 hamlets.

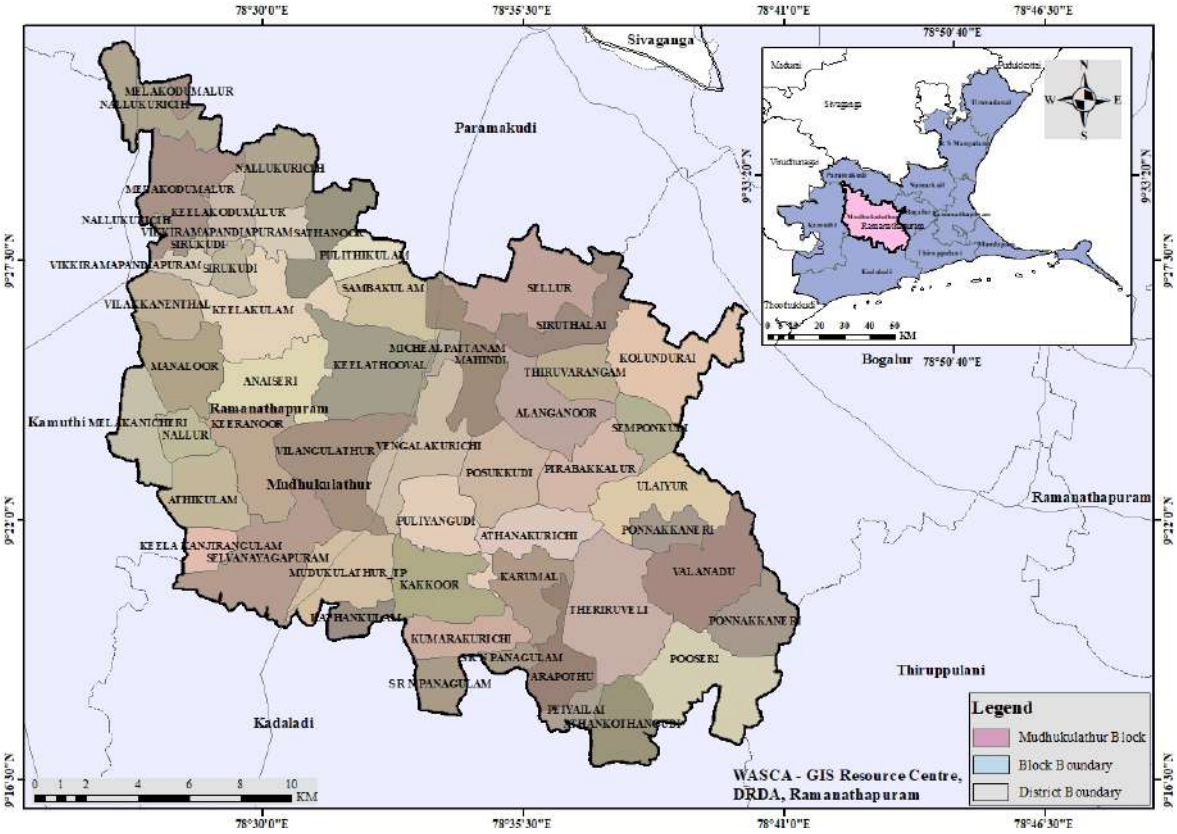


Figure 1.1. Mudukulathur Block and it's environ

According to Census 2011, the population of the Block is 96,638 The population density of the Block is 244 per Km² which is much lower than the district (331Km²) and the State's density (555 Km²). The population growth has increased in the last decade with an increase of 8.96% in population, observed since 2001. The proportion of sex ratio is 1003 females for 1000 males. The average literacy rate of this Block is 74.74 % which is much higher than the national average (72.98%). The male literacy rate is high (84.30%) than female literacy rate (65.22%). Vulnerable population, Scheduled Castes and Scheduled Tribes accounted for 29.71 % of the total population.

Economically, this rural Block is a backward one with low Human Development Index. According to the State Planning Commission, Government of Tamil Nadu's Human Development Report – 2017, 30.85 % families are in below poverty line (BPL). People of the Block are dependent on the agriculture and allied activities. 87.26% of the area is cultivated with Paddy. The rest of the area is cultivation with dry chilli, minor millets, Ragi, onion, other pulses and cotton. The Block has 18 milk societies with 3.8 lakh liters of milk being produced. This Block is famous for the Kanjirankulam Bird Sanctuary and Chitrangudi Bird Sanctuary. It is notable as a nesting site for several migratory Heron species that roost in the prominent growth of Babul trees there.

> The proportion of sex ratio is 1003 females for 1000 males.

> The average literacy rate of this Block is 74.74 % which is much higher than the national average (72.98%).

> 87.26% of the area is cultivated with Paddy.

Hydrologically, Mudukulathur Block comes under Palar, Lower Gundar, Paralayar and Uthirakosamangaiyar sub-basins of Gundar basin. Uthirakosamangaiyar and Paralayar Rivers flow through the Block. Gridhambal, Lower Vaigai (3), Lower Vaigai (4) and Terkku Upper macro- watersheds covers the Block with 94 micro-watersheds. (Figure 1.2). Situated in the rain shadow area, Ramanathapuram District has the extraordinary tank irrigation system which was built hundreds of years ago. The tanks were designed in such a way that the outflow from one tank would serve as the inflow for the next tank after it has reached its capacity, allowing the excess water to flow out into the next tank.

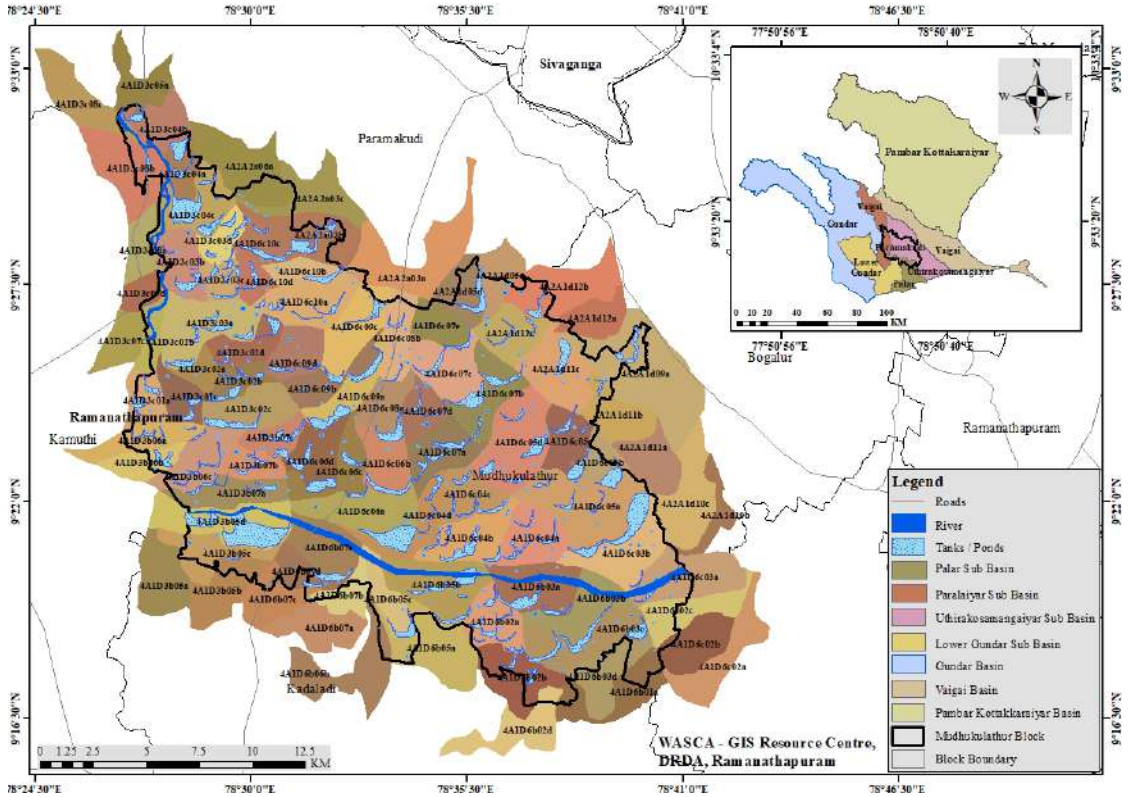


Figure 1.2. Watersheds – Mudukulathur Block

Water harvesting structures 'Ooranis' also play a huge role in groundwater conservation and recharge, guaranteeing availability of safe drinking water and also useful for farmers who do not have water source for irrigation or find it expensive. There are 182 major and minor tanks in this Block, 38 Ex Zamin MI tanks, 104 Panchayat MI tanks, 12 Vaigai basin (PWD) tanks and 28 Gundar basin (PWD) tanks (Human Development Report 2017). Figure 1.3 shows the spatial distribution of water bodies in this Block. Four firkas viz., Kakkur, Keelathuval, Melakodumalur and Theriruveli cover the Block, and all four firkas are safe in ground water development (CGWB's ground water assessment report 2017).

GROUND WATER LEVEL OF THIS BLOCK

SAFE - <70%	Kakkur, Keelathuval, Melakodumalur, Theriruveli

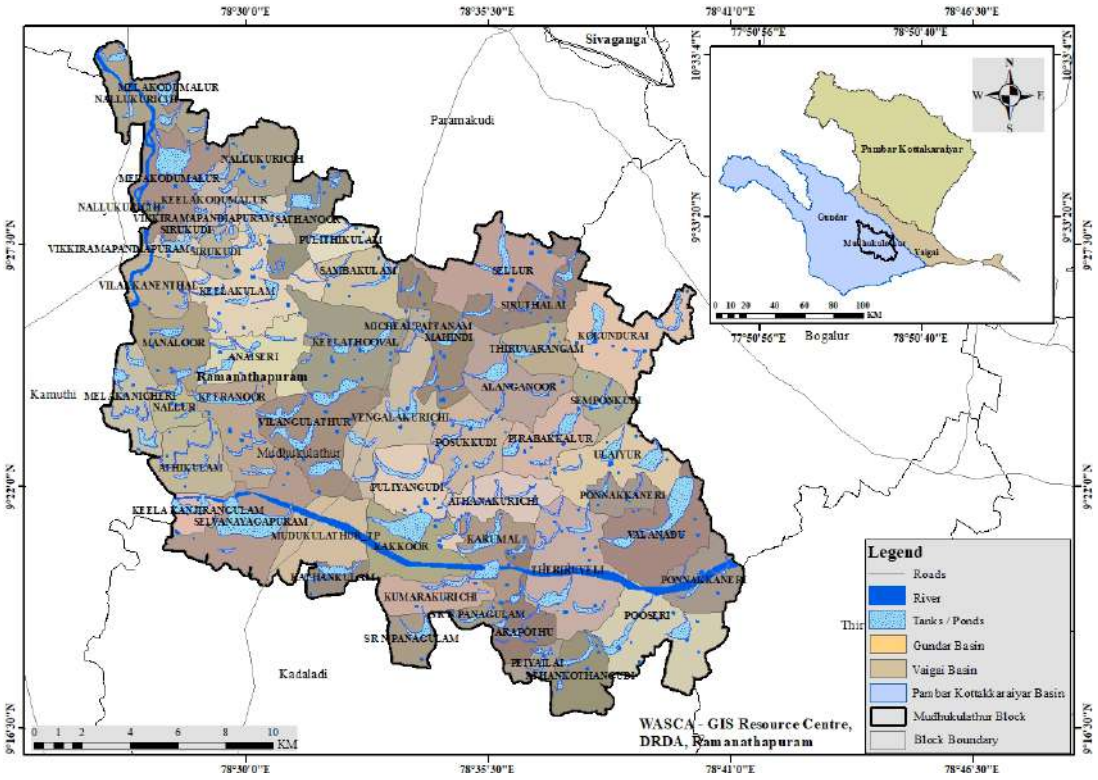
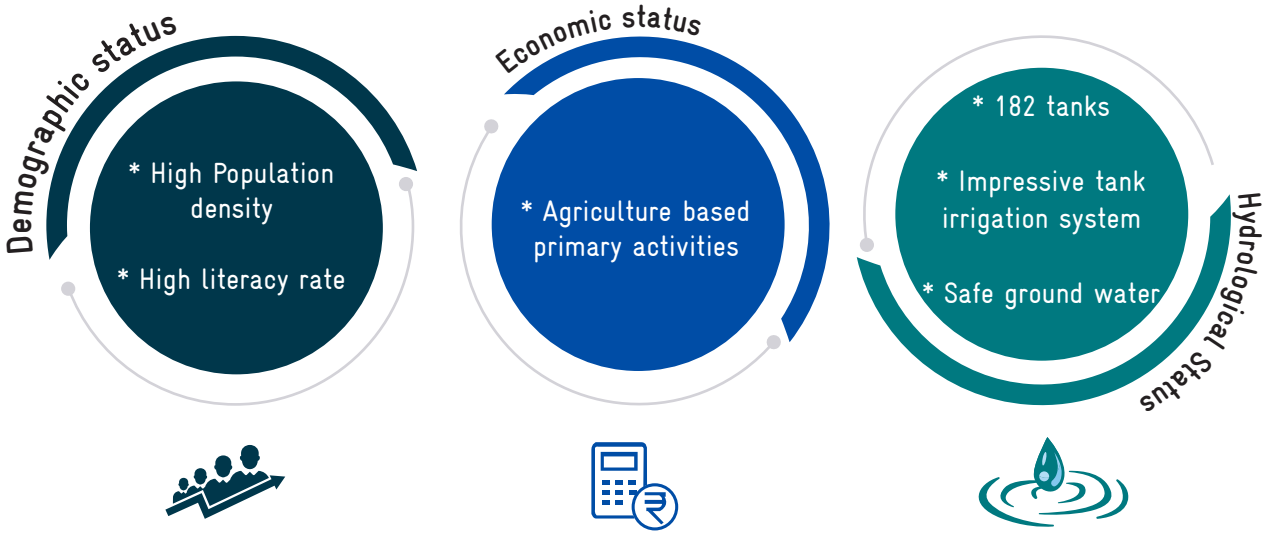


Figure 1.3. Spatial distribution of waterbodies



விண்இன்று பொய்ப்பின் விரிநீர் வியனுலகத்து
உள்நின்று உடற்றும் பசி

குறள் - 13

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

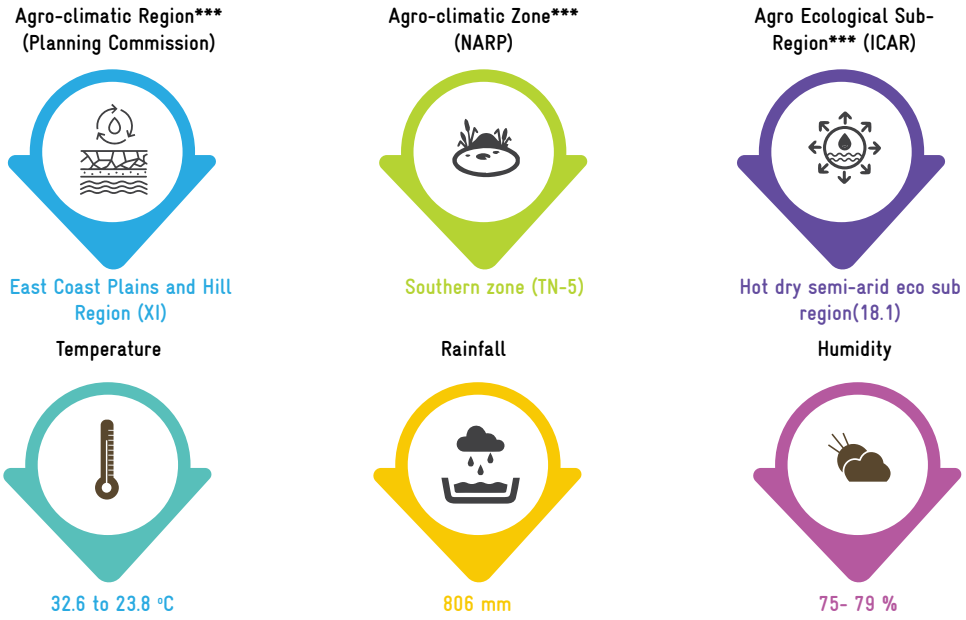
Thirukkural - 13

CHAPTER 2

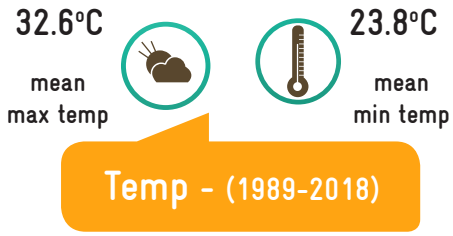
2 CLIMATE AND WATER SECURITY

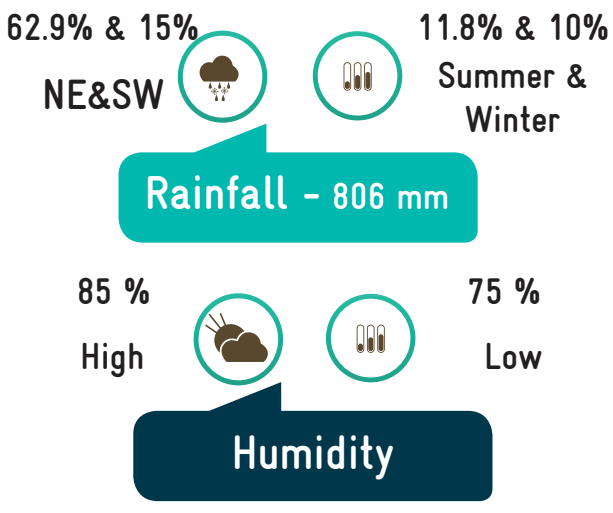
Water has always been a contentious subject in this region. This semi-arid region is classified as southern agro-climatic zone of State and East coast plains and Hills region according to the agro climatic regional classification of the Planning Commission. The general climate description of this region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

TABLE 1. GENERAL CLIMATE DESCRIPTION



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





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

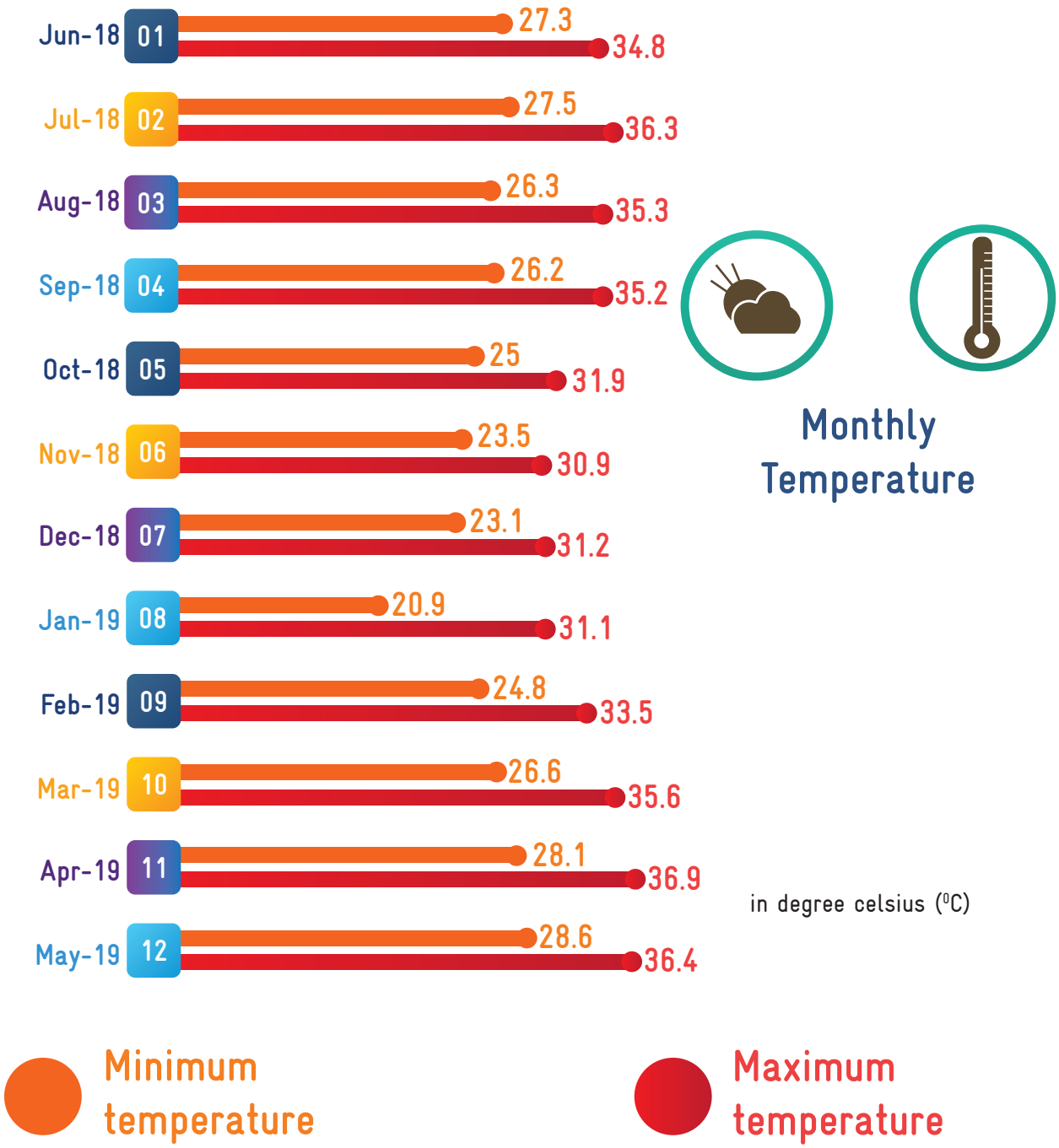


Figure 2.1. Monthly average maximum and minimum temperature

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

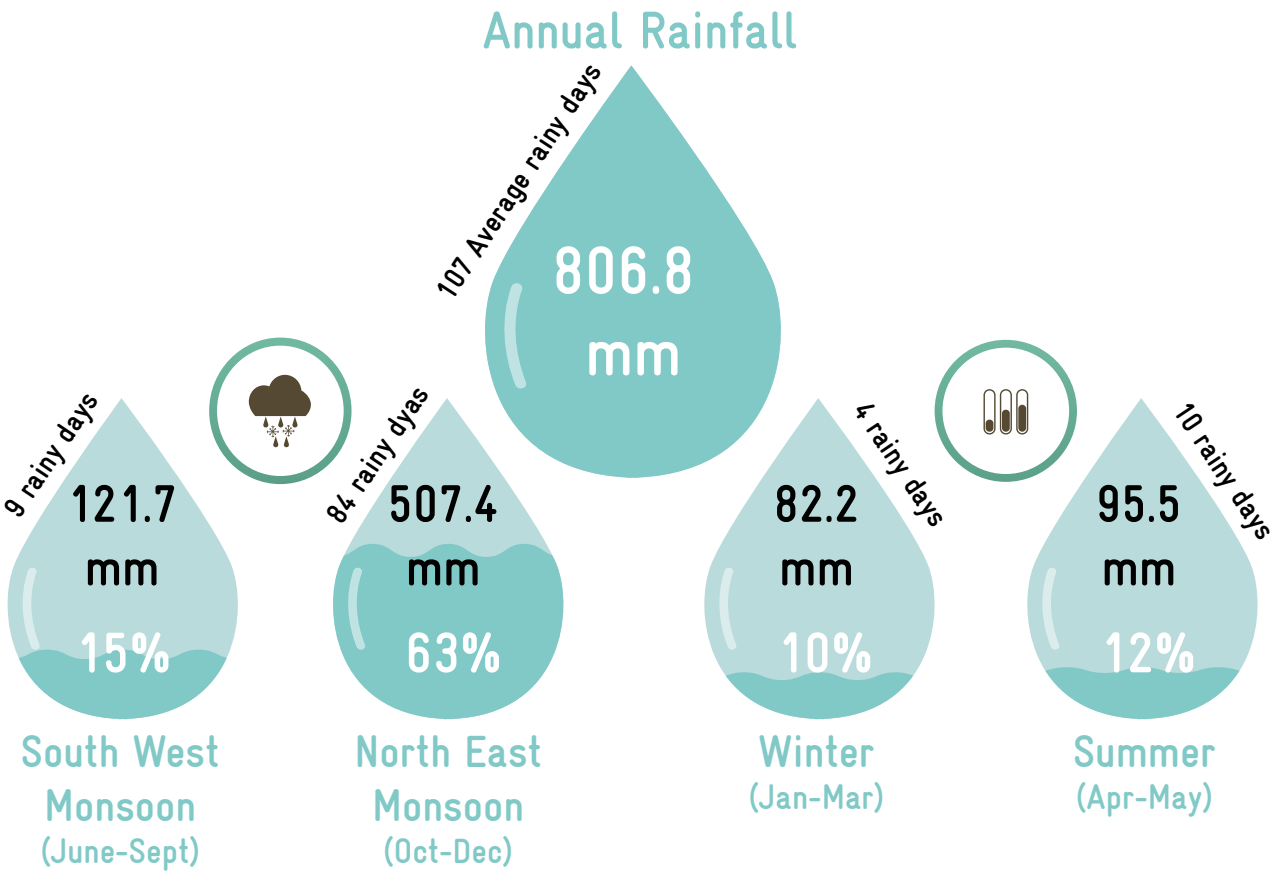


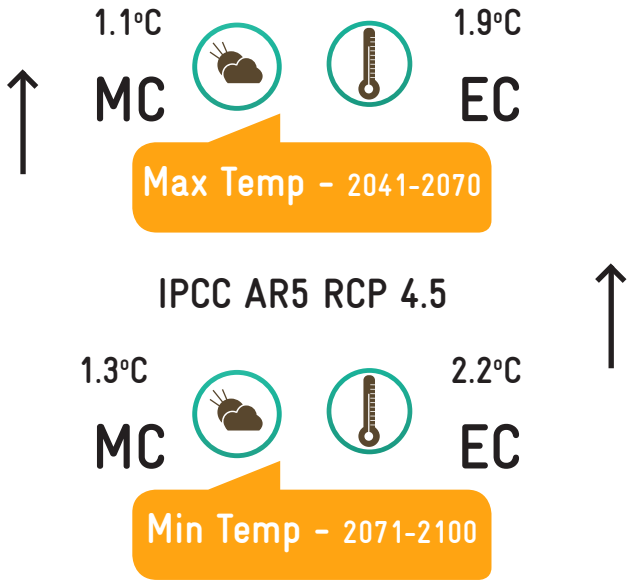
Figure 2.2. Season wise distribution of annual rainfall

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

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

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

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



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

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

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

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

2.1 CLIMATE RISKS

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

* Frequent Droughts
* Cyclones

Drought

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

Cyclones

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

Flood

Though it is a low rainfall region, it experiences heavy rain and flood during deep depressions/cyclones forms in the Bay of Bengal. State Disaster Management Authority (SDMA), Government of Tamil Nadu has identified 39 locations of Ramanathapuram district as flood vulnerability of medium category (inundation of water from 2 to 3 feet) based on past events (Ramanathapuram District Disaster Management Plan 2020-2021 SDMA). According to SDMA report, there are no flood vulnerable locations in this Block.

Sea level rise

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

2.2 WASCA CLIMATE VULNERABILITY INDICATORS

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

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

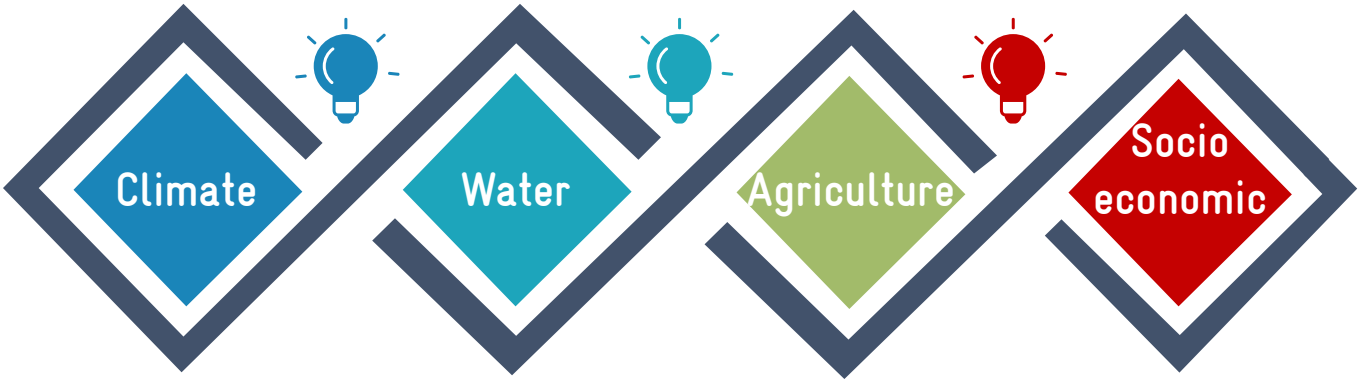
CWRM	Indicators of Rural water security vulnerability	Indicators label	Linked SDG
Climate	Changes in max temperature (^{O}C)	C1	Goal 13
	Changes in min temperature (^{O}C)	C2	
	Changes in rainfall (%)	C3	
	Excess rainfall years	C4	
	Deficient rainfall years	C5	
Water	Ground water extraction (%)	W1	Goal 6
	Ground water Recharge (m^3)	W2	
	Surface water availability (mm)	W3	
	Water gap (mcm)	W4	
	% of contamination	W5	
Agriculture	Rainfed area (%)	A1	Goal 15
	Cropping intensity (%)	A2	Goal 2
	Soil moisture (Kg/m^2)	A3	Goal 15
	Evapo-transpiration (Kg/m^2)	A4	
Socio-economic	Rural proportion (%)	S1	Goal 2
	Multidimensional poverty index	S2	Goal 1
	Source of drinking water within premises in rural (%)	S3	Goal 6
	Marginal farmers land holdings (%)	S4	Goal 1

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

2.3 COMPREHENSIVE ANALYSIS OF BLOCK LEVEL VULNERABILITY

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

TABLE 3. MAJOR PARAMETERS IDENTIFIED FOR BLOCK LEVEL VULNERABILITY ASSESSMENT



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

ஏரின் உழாஅர் உழவர் புயலென்னும்
வாரி வளங்குன்றிக் கால்

குறள் - 14

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

Thirukkural - 14

CHAPTER 3

GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

3 GRAM PANCHAYAT PLANNING IN MAHATMA GANDHI NREGS

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

The special focus on vulnerable households and communities are considered while preparing estimates for anticipated demand, list of works on individual land, and list of other works that provide direct individual benefits. The Convergent Planning Exercise shall make use of automatically included and deprived Households of SECC to ensure full coverage of poor and vulnerable households. Infrastructure built under Mahatma Gandhi NREGS leads to increased water availability for irrigation, groundwater recharge, increased agricultural production, and carbon sequestration. The Ministry of Environment, Forest and Climate Change recognizes Mahatma Gandhi NREGA as one of the 24 key initiatives to address the problem of climate change, while simultaneously improving the livelihoods of the poor. Mahatma Gandhi NREGA, particularly Category A activities, which are public works relating to natural resource management. Planning and design of works under Mahatma Gandhi NREGS should take into account, impacts of climate change in order to ensure resilience of vulnerable rural communities and make the benefits sustainable in the long run.

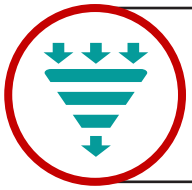
262 Total Kinds of works in Schedule-I of Mahatma Gandhi NREGA

182 Kinds of works relate to NRM alone

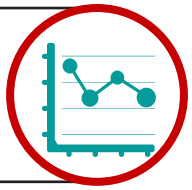
164 Kinds of works related to Agriculture & allied works

85 Water related works out of NRM

In pursuance of Schedule-I of Mahatma Gandhi NREGA, 262 kinds of works/ activities have been identified as permissible works, of which 182 kinds of works relate to NRM alone and out of the 182 NRM works, 85 are water related and 164 are related to Agriculture and allied works. The works taken up in Mahatma Gandhi NREGS should change from taking up individual, standalone works in a typical 'relief works mode' to an INRM perspective. Planned and systematic development of land and harnessing of rainwater following watershed principles should become the central focus of Mahatma Gandhi NREGS work across the country to sustainably enhance farm productivity and income of poor people. Even the works on private lands should be taken up following the principles of watershed management in an integrated manner. To facilitate evidence based scientific NRM planning process, Technological support shall be taken from National Remote Sensing Centre, ISRO for identification and holistic planning of permissible works to be taken up in the watersheds using GIS Technology (BHUVAN). The GIS plans shall be comprehensive ones incorporating all eligible works under Mahatma Gandhi NREGS and the same shall be implemented in a phased manner. Section 22 of the Annual Master Circular provides key steps for GIS based planning.



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

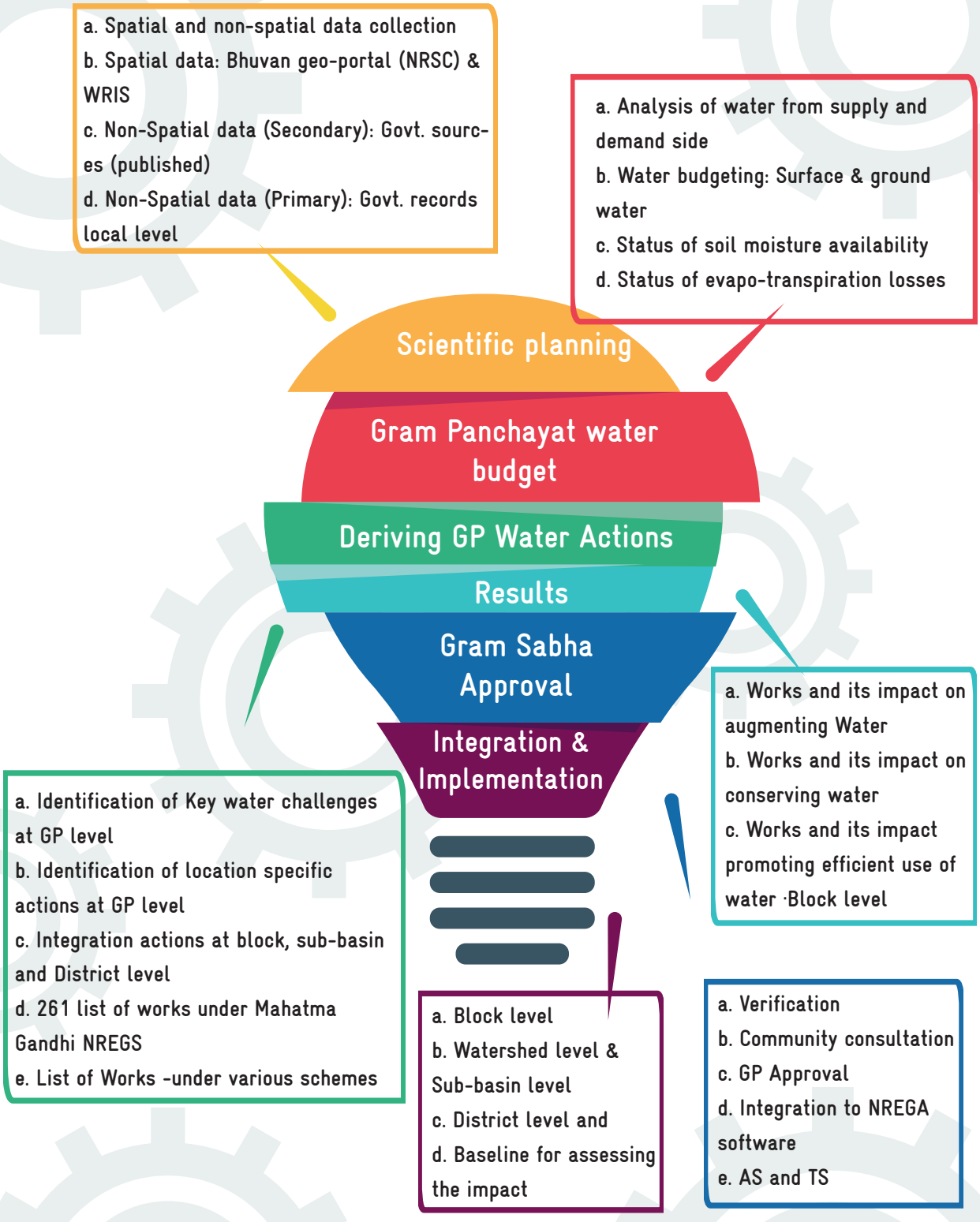


3.1 COMPOSITE WATER RESOURCE MANAGEMENT APPROACH

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

tion and soil moisture are used to understand the climate related issues. Lastly, Land use, watersheds, drainage networks and surface runoff, existing water supply and storage systems, water management for the key sectors and water demand are assessed to prepare the water budget for the GP (Box 1).

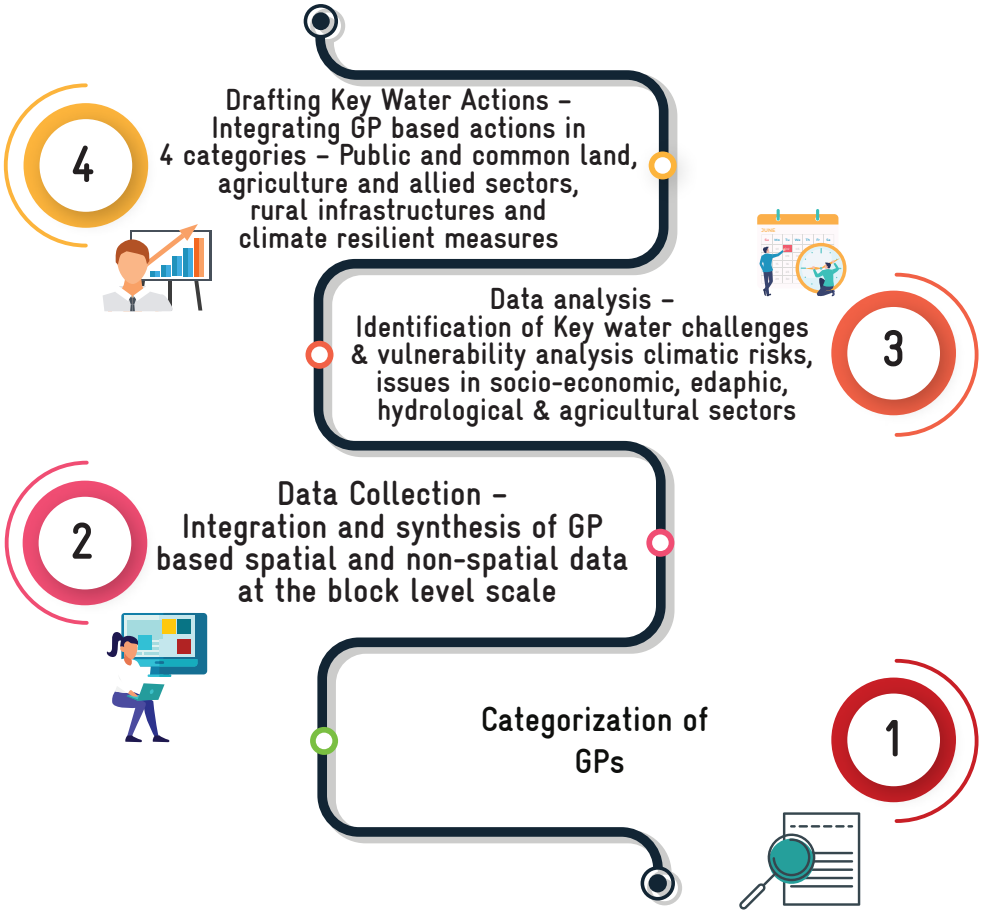
BOX 1. MAJOR COMPONENTS INVOLVE IN CWRM PLANNING WORKOUTS



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

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

STEPS INVOLVED IN BLOCK LEVEL ANALYSIS THROUGH CWRM APPROACH



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

BOX 2. STAGES OF CWRM PLANNING PROCESS

PRE-PLANNING STAGE

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

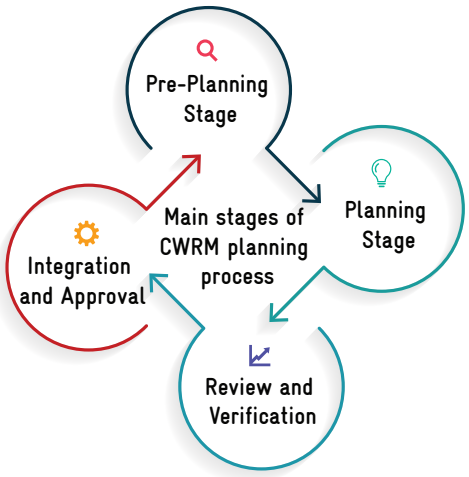
PLANNING STAGE

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

FOUR LEVELS OF CWRM PLANNING UNDER WASCA

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

2. INTEGRATING GP LEVEL PLANS AT BLOCK LEVEL



FOUR LEVELS OF CWRM PLANNING UNDER WASCA

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

4. INTEGRATING GP PLANS TO DEVELOP WASCA DISTRICTS CWRM PLANS

INTEGRATION AND APPROVAL

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

REVIEW AND VERIFICATION

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

3.2 CATEGORIZATION OF GPs

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

TABLE 4. CATEGORIZATION OF MUDUKULATHUR BLOCK GPs

NUMBER OF GP	GP TYPE	NAME OF THE PANCHAYAT
4	GP and revenue village data and boundary match (Type-I)	Selvanayagapuram, Kolundurai, Kumarakkurichi, Valandu
42	GPs having more than one GP, one Revenue Villages data, boundary (Type IV)	Alanganur, Anaiseri, Vilangalathur, Keeranoor, Kaakkor, Puliyangudi, Thiruvaragam, Siruthalai, Sellur, Vengalakurichi, Michaelpattinam, Mahindi, Kaelakulam, Sirugudi, Puludhikulam, Vilakanendal, Sambakulam, Sathanur, Keelathooval, Manaloor, Melakanniser, Nallur, Melakodumalur, Nallukuruchi, Vikiramapandiapuram, Athikulam, Keelakanchi-rankulam, Athanakurichi, Pirabakkallur, Posukudi, Keelakodumalur, S.R.N Palangulam, Kathankulam, Pooseri, Ponnakkaneri, Ulaiyur Karumal, Arapothu, Sembongudi, Periya ilia, Athankothankudi, Theriruveli

3.3 DATA COLLECTION – SPATIAL & NON SPATIAL

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

SPATIAL DATA

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

NON SPATIAL DATA

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

- Watershed based analysis is to understand the hydrological and administrative boundaries. This aids in understanding the profile and condition of the watershed at macro or micro level for planning relevant water actions

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

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

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

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

ASSESSMENT OF GROUND WATER QUALITY AND SEA WATER INTRUSION

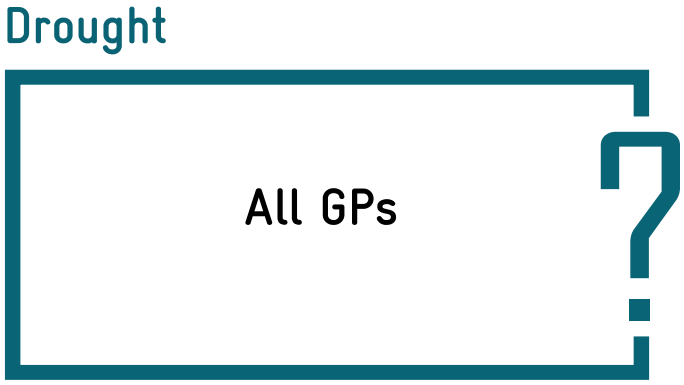
The vulnerability of the groundwater quality, seawater intrusion in the aquifers were assessed and spatially mapped for the Ramanathapuram District. The water quality samples were collected from 380 locations throughout the district during pre-monsoon and post-monsoon season. The collected samples were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

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

3.4 CWRM PLANNING ANALYSIS – CLIMATE

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

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 is necessary. Both spatial and non-spatial data including details and status on watershed and drainage network, canal network, irrigation facilities, catchments area wise available runoff, conserved runoff, present ground water extraction, water demand for domestic, agriculture and livestock, ground water utilization for domestic, agriculture and livestock are collected from authorized open sources and analysed at Block level.

3.5.1 SPATIAL DATA

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

3.5.1.1 Geomorphology: Geomorphology deals with the scientific study of "landforms and landscapes, including their description, type, and genesis". Landform is the end product resulting from the interactions of the natural surface genesis and the type of rock. The scope of geomorphology was further expended with landform maps, which are widely used in various fields of hydrology, pedology, geoscience, urban and regional planning etc. Mudukulathur Block is engrossed with coastal origin older deltaic plain landform unit (Figure 3.1). GP-wise detailed view of the landforms with area in percentage is shown in the illustration below. This fundamental information of landforms by its units will act as a critical input while identifying suitable sites for NRM activities under CWRM plan preparation.

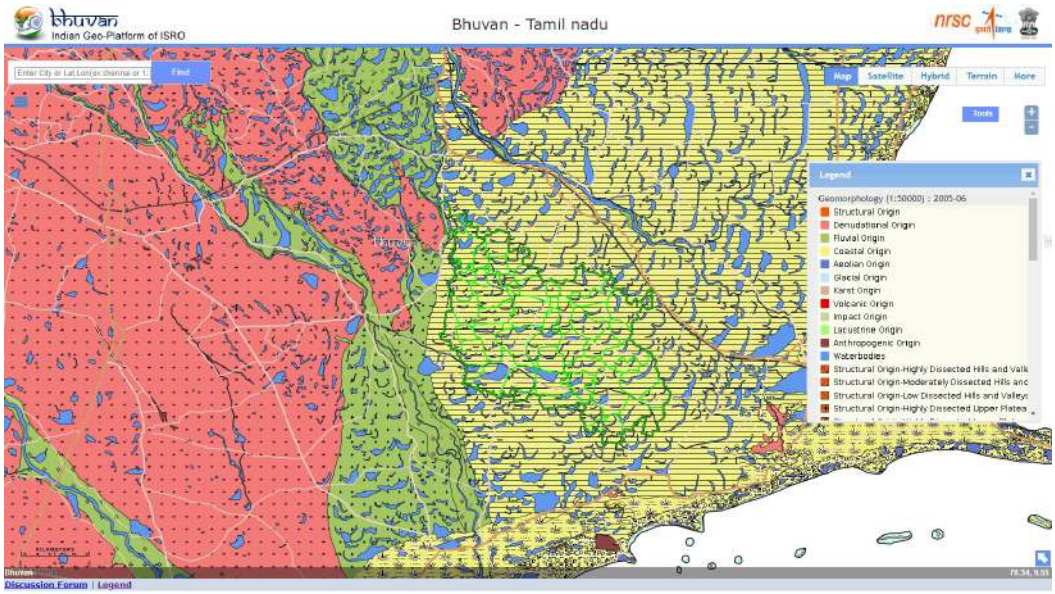


Figure 3.1. Geomorphology map

Landform unit	Area coverage in %	Gram Panchayat
Coastal Origin - Older Deltaic Plain		
	98%	Alangaanoor, Anaiseri, Arapothu, Athanakurichi, Athankothankudi, Athikulam, Kakkur, Karumal, Kathakulam, Keelakodumalur, Keelakulam, Keelathooval, Keelathuval, Keeranur, Kolunthurai, Kumarakurichi, Makindi, Manaloor, Melakkanniseri, Melakodumalur, Michealpattanam, Nallukurichi, Nallur, Periya Ilai, Pirabukkalur, Ponnakkaneri, Pooseri, Posukkudi, Pulithikulam, Puliyangudi, S.R.N.Palankulam, Sambakulam, Sathanur, Sellur, Selvanayagapuram, Semponkudi, Sirugudi, Siruthalai, Theriruveli, Thiruvarangam, Ulaiyur, Valanadu, Vengalakurichi, Vikkiramapandiapuram, Vilakkanenthal - 100%, Keelakanchirankulam - 30%

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

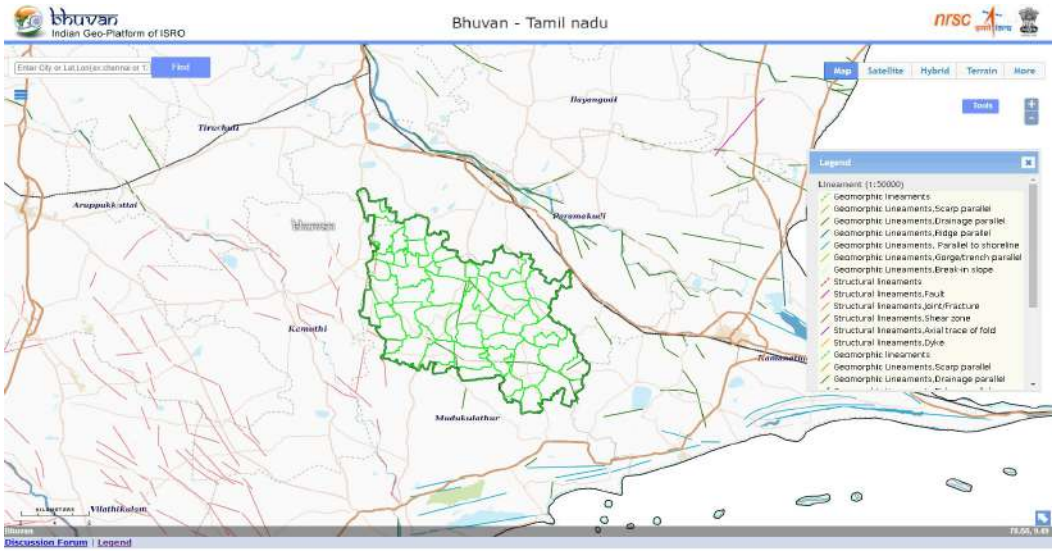


Figure 3.2. Lineament map

Lineament type	Gram Panchayat
Geomorphic lineaments, Drainage parallel	
	Arapodhu, Kakkoor, Mahindi, Michaelpattinam, Mudukulathur, Ponnakaneri, Pooseri, Selvanayagapuram, Therurveli, Vengalakurichi

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

Figure 3.3. Terrain map

3.5.1.4 DEM: The DEM is an important element in the representation of the terrain and only one which determines relief forms such as valleys and hills, and the steepness or gentleness of slopes geometrically. In the Block, the higher elevated area in the North-West region is noticed and elevation getting decreases as move towards coastal shore (Figure 3.4). The map plays a vital role in delineation of watershed and its units, used in planning and identifying recharge structures, farm ponds and construction of grey water drain network etc.

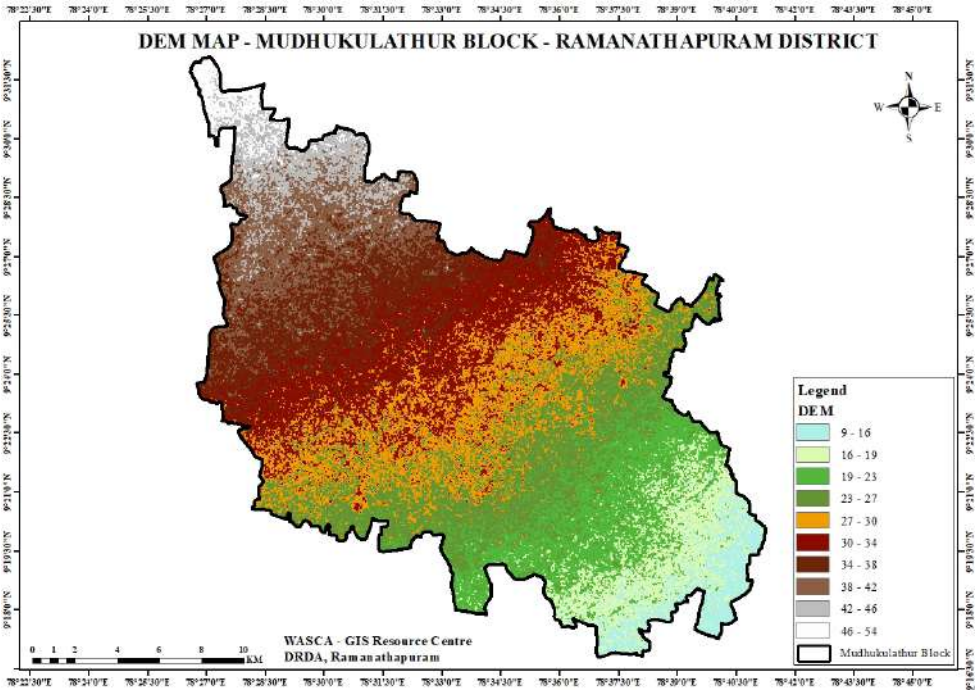


Figure 3.4. DEM map

3.5.1.5 Slope: The average slope of a terrain feature is calculated from contour lines on a topology map or DEM. Slope is typically expressed in percentage, angle, or in ratio. Slope map illustrates the measure of steepness or the degree of inclination of a feature relative to the horizontal plane. Very flat (0-1 %) to flat (1 – 3 %) slope ranges are noticed in the Block (Figure 3.5). Details of GP-wise slope area in percentage is shown in the illustration below. Slope information plays a significant role in identification of soil eroded sites, depth profiles, also used in analyzing / proposing soil conservation measures such as check dam, bunding land development, farm ponds etc.

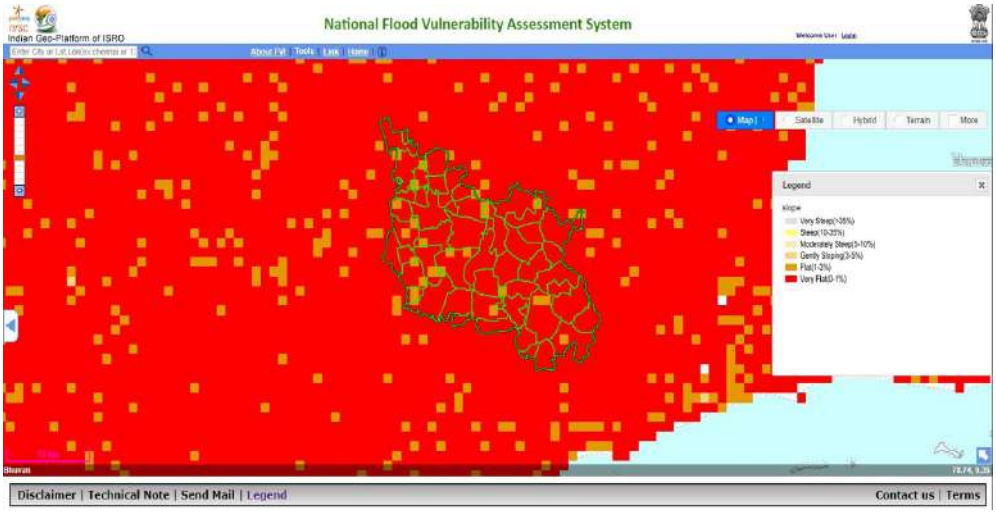


Figure 3.5. Slope map

Slope range	Area in %	Gram Panchayat
Very Flat (0-1%)	95%	Alangaanoor, Arapothu, Athanakurichi, Athankothankudi, Karumal, Kathakulam, Keelakanchirankulam, Keelakulam, Keelathooval, Kolunthurai, Kumarakurichi, Melakkanniseri, Melakodumalur, Michealpattanam, Nallukurichi, Nallur, Periya Ilai, Pirabukkalur, Ponnakkaneri, Pooseri, Pulithikulam, Puliyangudi, S.R.N.Palankulam, Sambakulam, Sathanur, Sellur, Selvanayagapuram, Semponkudi, Sirugudi, Siruthalai, Thiruvarangam, Ulaiyur, Valanadu, Vengalakurichi, Vikkiramapandiapuram, Vilakkanenthal, Vilankulathur - 100%, Kakkur, Posukkudi - 90%, Athikulam, Keeranur, Makindi, Theriruveli - 80%, Anaiseri - 70%, Keelakodumalur - 60%, Manaloor - 40%
Flat (1-3%)	30%	Keelakanjirangulam - 70%, Manaloor - 60%, Keelakodumalur - 40%, Anaiseri - 30%, Athikulam, Keeranoor, Mahindi, Theirurveli - 20%, Kakkoor, Pooseri - 10%

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

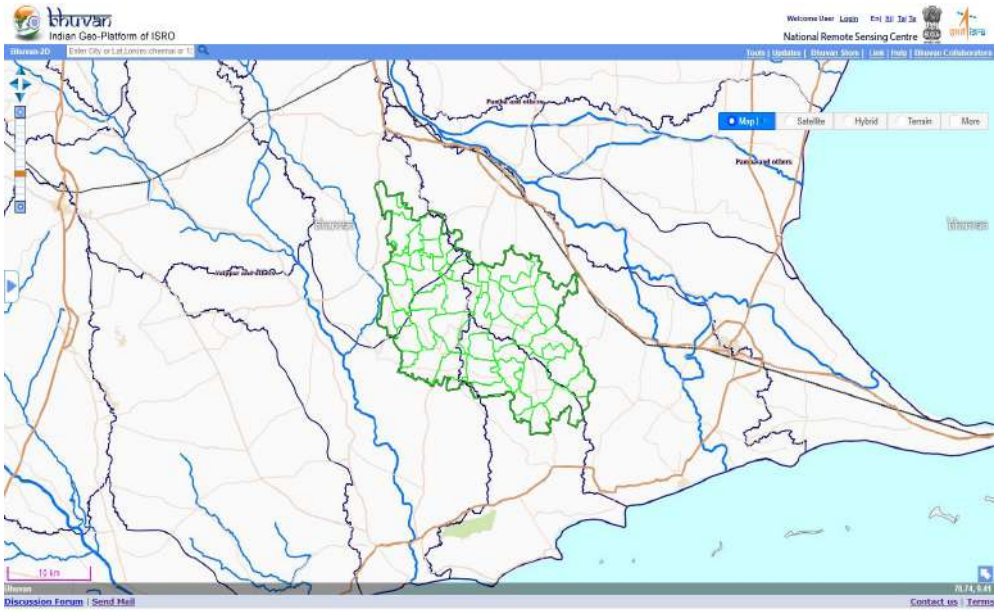


Figure 3.6. Drainage network

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

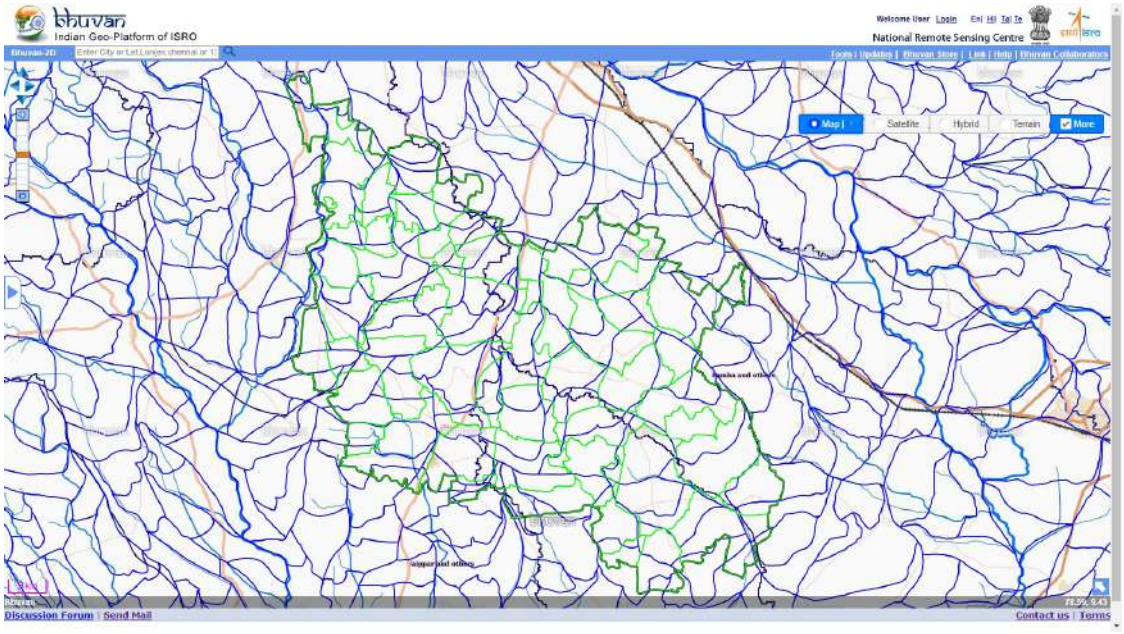


Figure 3.7. Watershed map

3.5.1.8 Ground water perspectives: Ground water is one of the important natural resources in a semi-arid region like Mudukulathur 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 the Block area witnessing the ground water is available between 30 to 80 m deep wells with yield of 50 to 100 LPM while banks of higher order drainage network witnessed the GW between 30 to 80 m deep well with a yield from 100 to 200 LPM (Figure 3.8). The GPs wise details of GW prosperity is shown in the illustration below. This specific information will play a crucial role in identifying sites for recharge structures in order to address water scarcity issues in the Block.

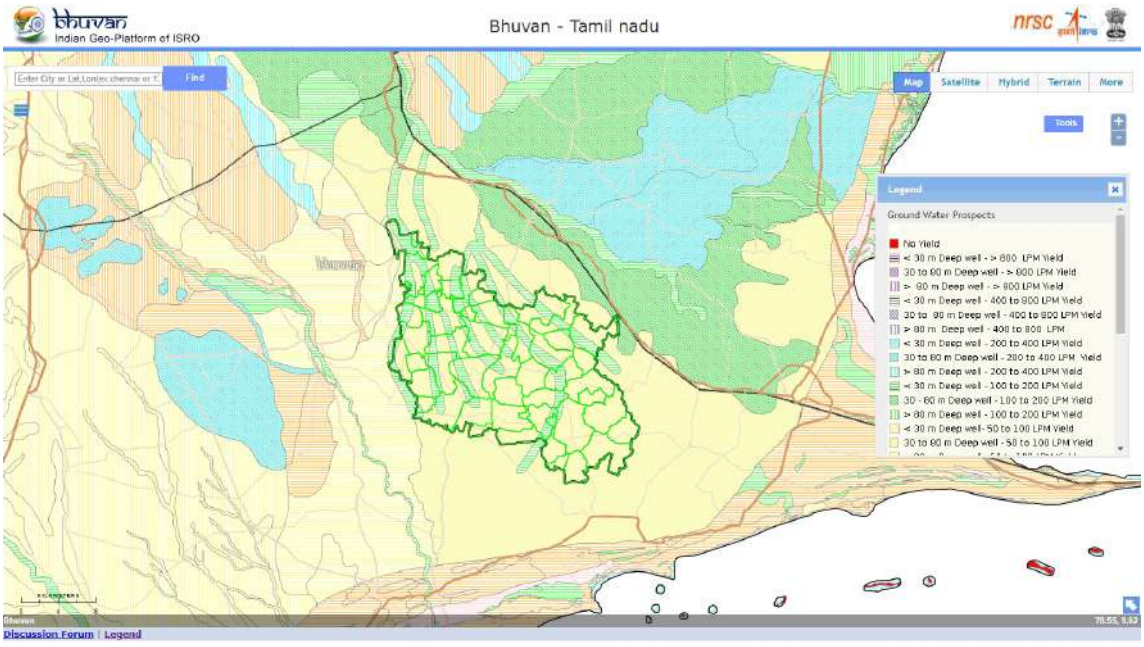


Figure 3.8. Ground water perspective map

Groundwater Prospects	Area in %	Gram Panchayat

<30m Deep Well-100 to 200 LPM Yield

50%

Pirabakkalur - 75%, Kolundurai, Sellur, Sirukudi, Vilakkanendhal - 70%, Alangaanoor, Keeranoor - 65%, Anaiseri, Karumal, Keelakodumalur, Keelathooval, Mahindi, Melakodumalur, Siruthalai, Srn Palangulam - 60%, Athakothangudi, Manaloor, Sambakulam - 55%, Keelakulam, Nallukurichi, Sathanoor - 50%, Athakothangudi, Manaloor, Sambakulam - 45%, Anaiseri, Karumal, Keelakodumalur, Keelathooval, Mahindi, Melakodumalur, Siruthalai, Srn Palangulam - 40%, Alangaanoor, Keeranoor - 35%, Kolundurai, Sellur, Sirukudi, Vilakkanendhal - 30%, Pirabakkalur - 20%

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

100%

Arapothu, Athankothankudi, Athikulam, Kakkur, Kathakulam, Keelakanchirankulam, Kumarakurichi, Melakkanniseri, Michealpattanam, Nallur, Periya Ilai, Ponnakkaneri, Pooseri, Posukkudi, Pulithikulam, Puliyangudi, Selvanayagapuram, Semponkudi, Theriruveli, Thiruvarangam, Ulaiyur, Valanadu, Vengalakurichi, Vikkiramapandiapuram, Vilankulathur

3.5.2 NON SPATIAL DATA

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

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

Canal Network	Extent
Canal Network	
Length of Main Canal (m)	1,76,760
Length of Minor Canal (m)	30,730
Length of Distributaries (m)	3,340
Water Courses (Field Channels) (m)	2,38,330
Traditional Water bodies (No.)	
Number of Tanks (PWD & Union) (No.)	170
Number of Ooranis (No.)	352
Irrigation Facilities (ha)	
Tank Irrigation	13,909.65
Canal Irrigation	1,175.63
Open & Tube Well Irrigation	1,651.00
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	1,562.50
Average Catchment Area	326.20
Bad Catchment Area	3,165.60
Watershed and Drainage Networks	
Length of Natural Drainage Lines (m)	1,56,596.30
Number of Natural Drainage Lines (No.)	148
Number of Micro-watersheds (No.)	297
Water Demand	
For Humans (ha.m)	331.40
For Livestock (ha.m)	60.04
For Agriculture (ha.m)	30,398.18
% GW Utilization for Drinking (%)	92.33
% GW Utilization for Livestock (%)	43.22
% GW Utilization for Agriculture. (%)	20.97
% SW Utilization for Drinking (%)	7.67
% SW Utilization for Livestock (%)	56.78
% SW Utilization for Agriculture (%)	79.03

3.5.2.1 Existing Water Structures

Waterbodies are the life lines of local communities for their lives and livelihoods. The Block has structured traditional water storage units such as tanks and ooranis. It is noticed that the number of Ooranis are more (352) than tanks (170) (Figure 3.9).

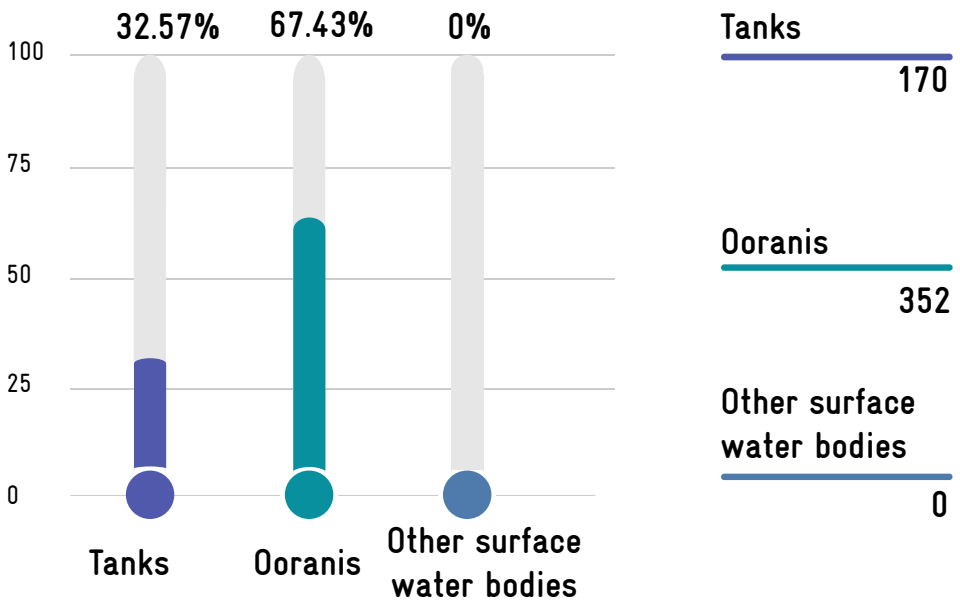


Figure 3.9. Traditional waterbodies

3.5.2.2 Sources of Irrigation

The total area under irrigation in the Block is 16,736.28 ha, of which 83.11 % (13,909.65 ha) area is irrigated through tanks, followed by 9.86 % (1,651 ha) through open/tube well and the remaining 7.02% (1,175.63 ha) area is through canal-based irrigation (Figure 3.10).

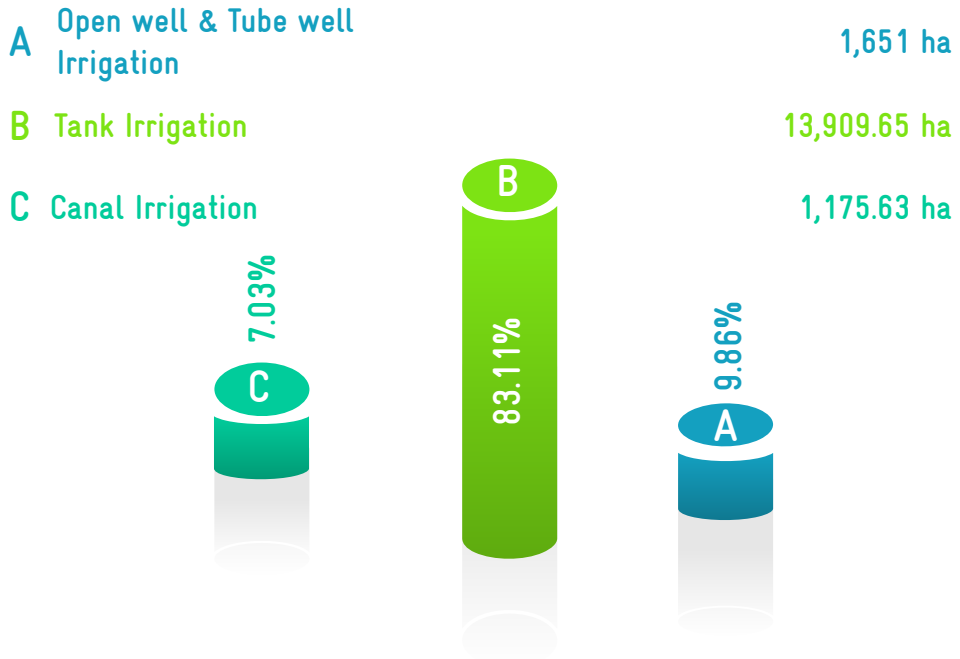


Figure 3.10. Irrigation sources

3.5.2.3 Available Run off

The total available runoff in the catchment area is 5,054.30 ha.m out of which highest of 62.63 % is from bad catchment area followed by 30.91 % is good catchment area and the remaining 6.45 % is from average catchment area. As the area has worse catchment area, the runoff generated is more (Figure 3.11).

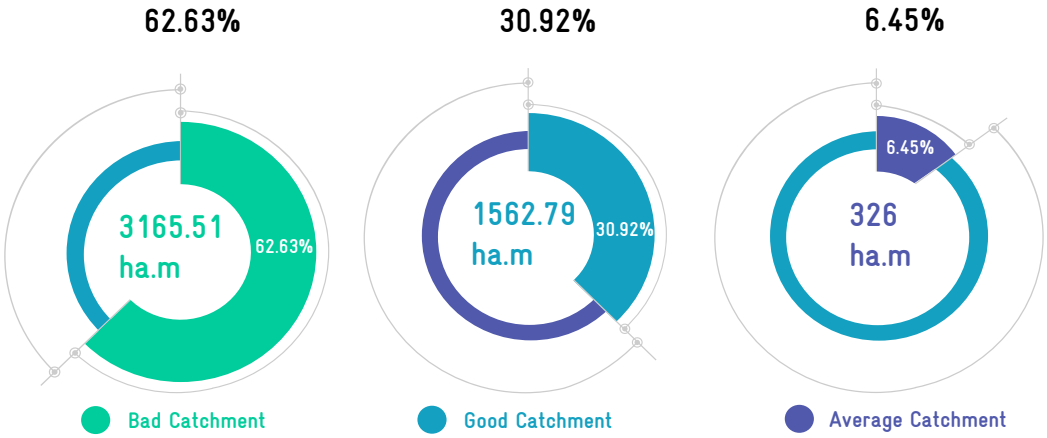
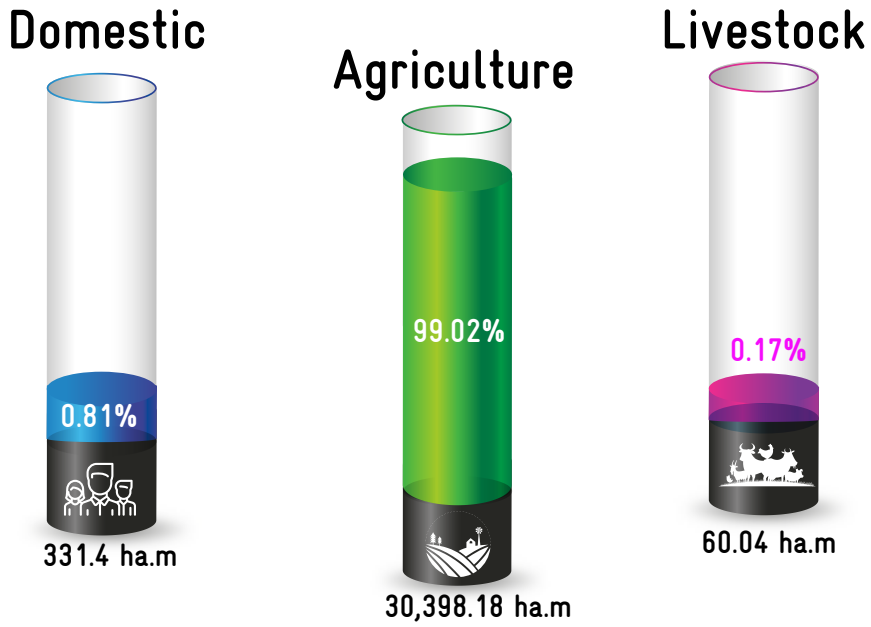


Figure 3.11. Runoff from catchments

3.5.2.4 Water Demand

The total demand for water including domestic, agriculture and livestock purpose is 30,789.62 ha.m. The highest demand is from the agriculture sector of 30,398.18 ha.m (99.02 %) followed by domestic use demand of 331.4 ha.m (0.81 %) and rest is from livestock.



Out of the total water demand, 92.33 and 43.22 % for domestic and livestock purpose usage of water is met through ground water, while 79.03 % for Agriculture purpose is met through surface water sources (Figure 3.12).

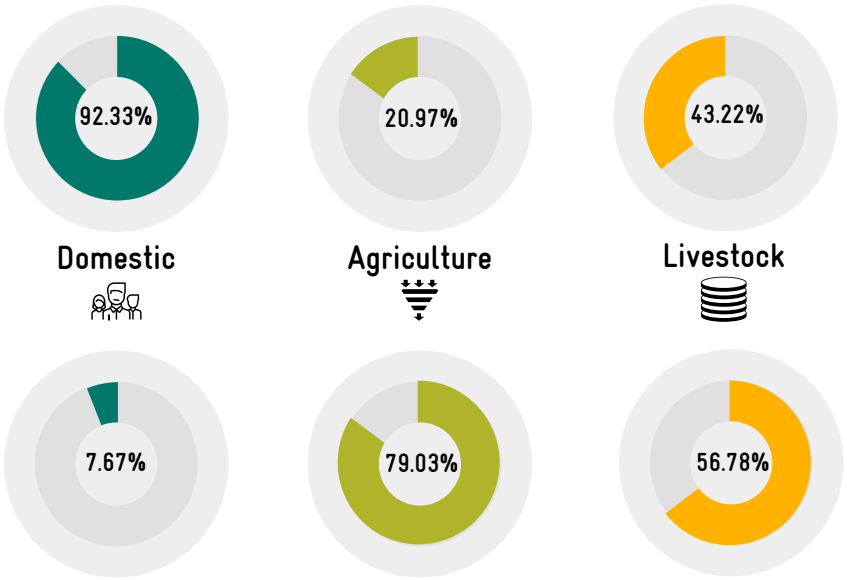


Figure 3.12. Sector-wise water utilization

3.5.3 ANALYSIS OF PHYSICOCHEMICAL PARAMETERS

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

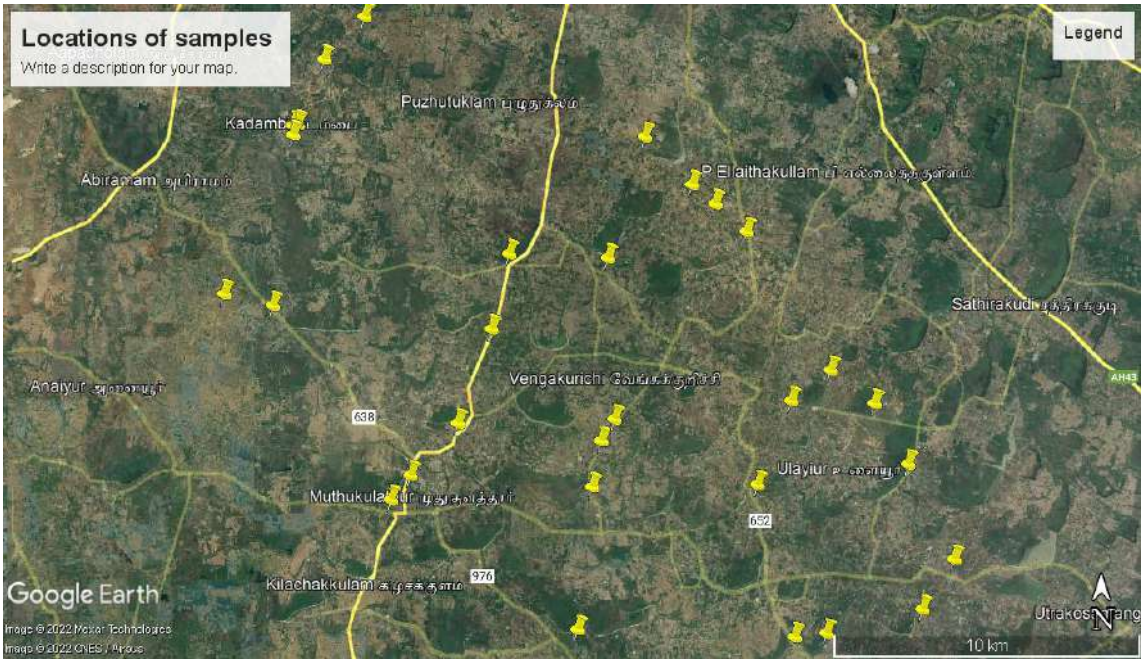


Figure 3.13. Location of water samples

3.5.3.1 Water Quality Index

The WQI is defined as a measure of rating that provides the composite influence of individual water quality parameter to overall water quality. WHO (2004) recommended ten parameters such as pH, TDS, HCO_3, Cl, SO_4, NO_3, Ca, Mg, Na and K to determine the quality of water. The results showed that the average content of ions was as follows: Cl > TH > Na > TA > Ca > HCO_4 > Mg > CO4 > S04 > NO_4 > K. The predominant hydro-chemical facies are Chloride (Cl) while Potassium (K) is witnessed in minute quantities. The excellent water quality /suitable water for domestic purpose is found in almost one fourth area in dispersed spots across Block area (blue colour in Figure 3.14) while very poor-quality water/ unsuitable water for domestic purpose with index value >300 is found in three spots. Buffer area of very poor sites falls under poor quality water of index zone ranging from 200 to 300. However major area of the Block falls under good water quality zone of index value range 50-100 (Figure 3.14). These zones act as inputs in identifying suitable sites to propose appropriate treatment measures. GP wise water quality during pre and post monsoons are attached in Annexure 3.8 and 3.9.

Physicochemical parameters	Cl	TH	Na	TA	Ca	HCO_4	Mg	CO_4	$S0_4$	NO_4	K
Average in mg/l	1,367.65	694.82	564.34	425.23	327.90	307.87	219.43	91.80	80.40	33.06	29.29

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

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

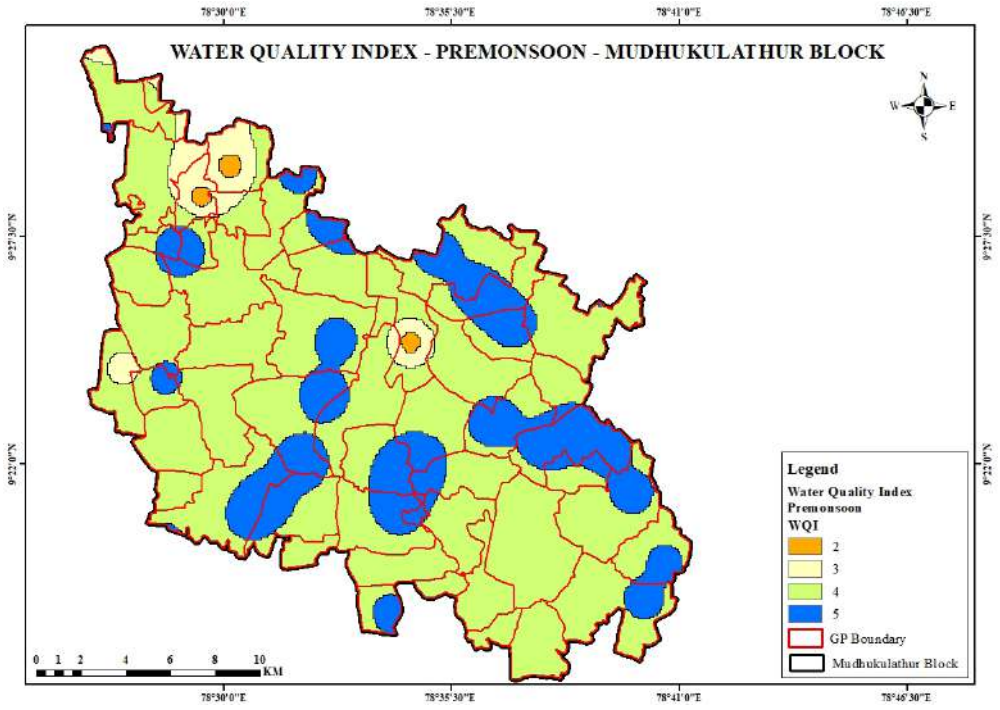


Figure 3.14. Water Quality Index

3.5.3.2 Seawater Mixing Index

SWI parameter is calculated based on mixing of major ionic constituents (Na, Cl, Mg, and SO4) of sea water to ground water during pre-monsoon season. The results show that the average content of ions was as follows: Na > Ca > Mg > S04. The predominant hydro-chemical facies are Sodium followed by Calcium while Sulphate is less. Geographically very minute two spots were found with high SWI while two zones were with less sea water mixed. However, most of the Block area falls under the index value range 2-3 which is moderate (Figure 3.15).

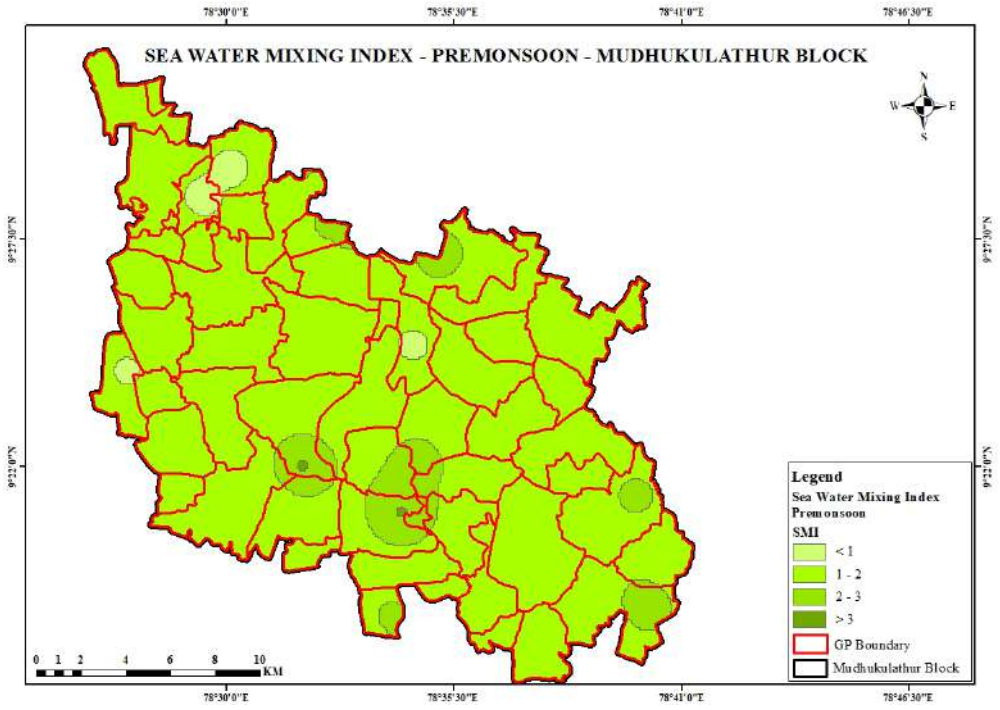


Figure 3.15. Seawater Mixing Index

3.5.3.3 Salinity

Seawater mix and salinity in the water are directly proportional, higher the sea water mix higher the salinity in the water. Most of Block area witnessed the less salinity index value while higher salinity zones are found across peripheral region of the Block (Figure 3.16).

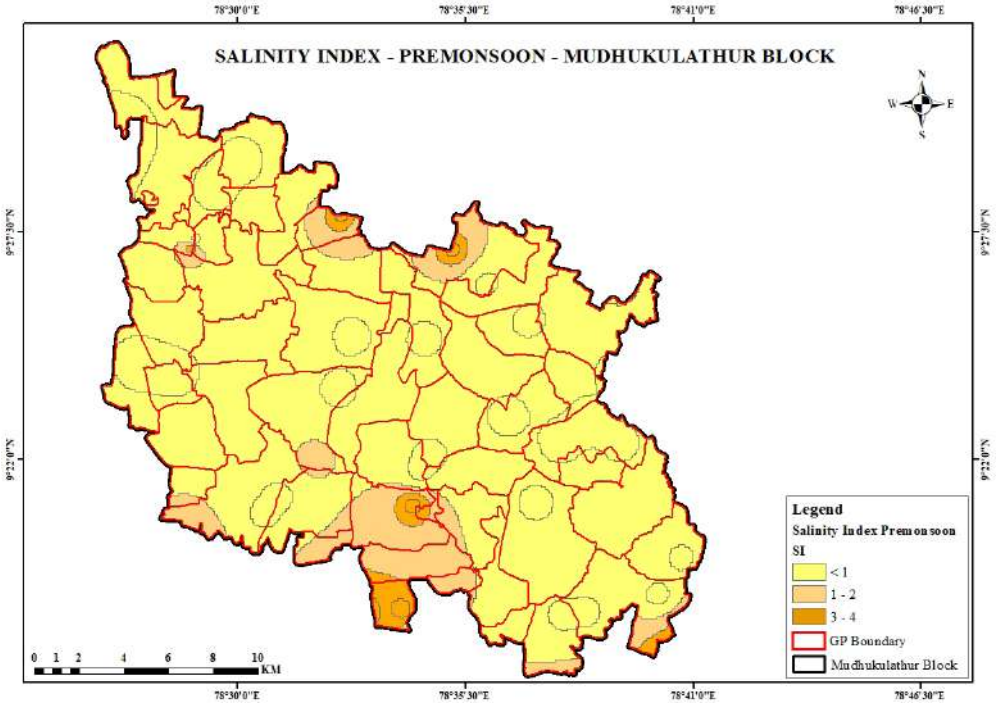


Figure 3.16. Salinity Index

3.6 CWRM PLANNING ANALYSIS-AGRICULTURE

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

3.6.1 SPATIAL DATA

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

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

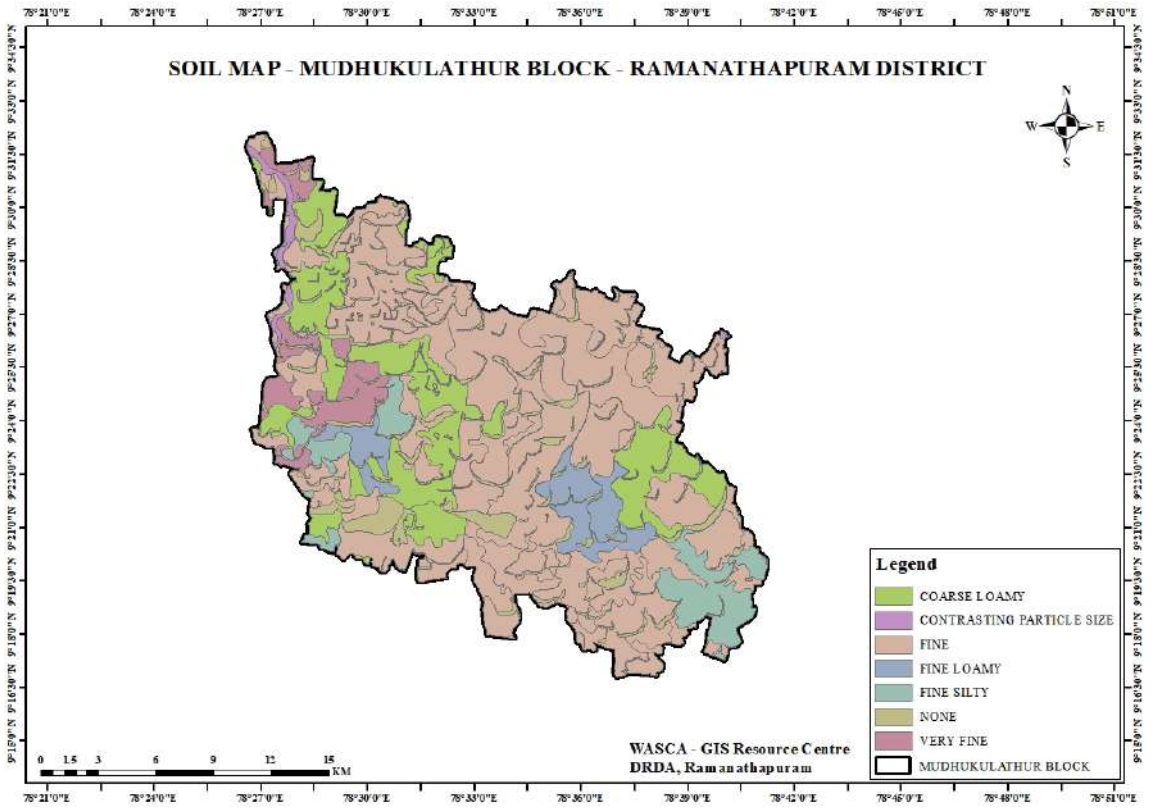


Figure 3.17. Soil texture

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

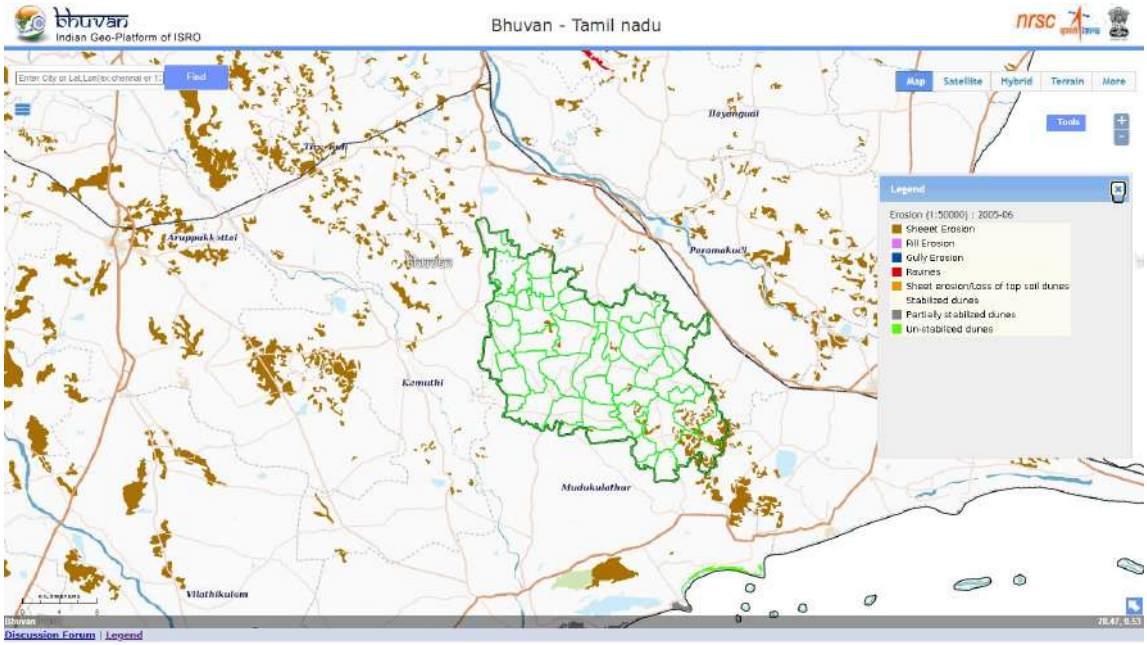


Figure 3.18. Soil erosion map

Erosion type	Area in %	Gram Panchayat
Sheet Erosion		
	23%	Pooseri - 55%, Valanadu - 50%, Ponnakaneri - 45%, Arapothu, Karumal - 10%, Anaiseri, Keelakulam, Mahindi - 5%

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

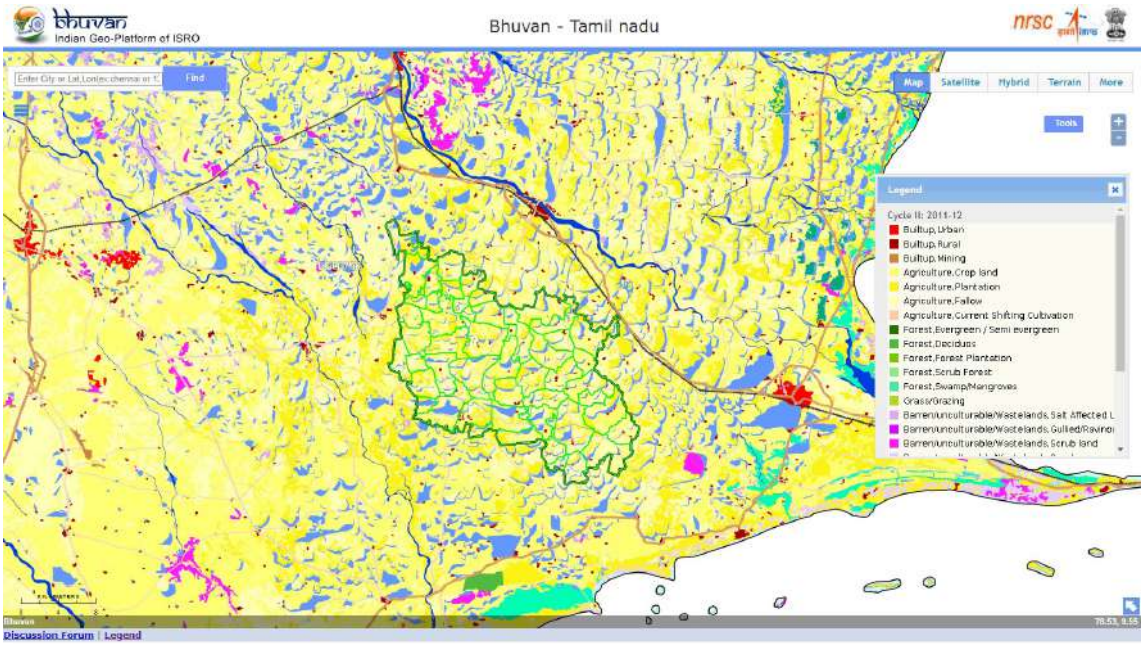


Figure 3.19. Land Use Land Cover map

Land Use	Area coverage in %	Gram Panchayat
Agriculture, Fallow lands	50%	Kathakulam, Posukkudi - 70%, Keelathooval, Nallukurichi, Pooseri, Semponkudi, Valanadu - 65%, Alangaanoor, Athanakurichi, Kumarakurichi, Melakodumalur, Periya Ilai, S.R.N.Palankulam, Vilakkanenthal - 60%, Kakkur, Manaloor, Pulithikulam, Sellur, Thiruvarangam, Vengalakurichi - 55%, Kolunthurai, Michealpattanam, Pirabukkalur, Siruthalai, Vilankulathur - 50%, Arapothu, Athankothankudi, Athikulam, Keelakanchirankulam, Nallur, Ulaiyur - 45%, Keelakodumalur, Keelakulam, Keeranur, Melakkanniseri, Puliyangudi, Sambakulam, Selvanayagapuram, Theriruveli, Vikkiramapandiapuram - 40%, Makindi, Ponnakkaneri, Sathanur - 35%, Anaiseri, Karumal, Sirugudi - 30%
Agriculture, Crop lands	27%	Makindi, Posukkudi - 45%, Karumal, Kumarakurichi, Nallur, S.R.N.Palankulam, Selvanayagapuram, Vilakkanenthal - 40%, Alangaanoor, Keeranur, Michealpattanam, Pulithikulam, Semponkudi, Vilankulathur - 35%, Athanakurichi, Kakkur, Keelakanchirankulam, Manaloor, Periya Ilai, Sambakulam, Sellur, Thiruvarangam, Vikkiramapandiapuram - 30%, Arapothu, Kathakulam, Melakkanniseri, Ponnakkaneri, Sathanur, Theriruveli, Ulaiyur - 25%, Anaiseri, Athankothankudi, Keelakulam, Kolunthurai, Nallukurichi, Pooseri, Puliyangudi, Sirugudi - 20%, Athikulam, Keelakodumalur, Keelathooval, Melakodumalur, Pirabukkalur, Siruthalai, Valanadu - 15%, Vengalakurichi - 10%

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

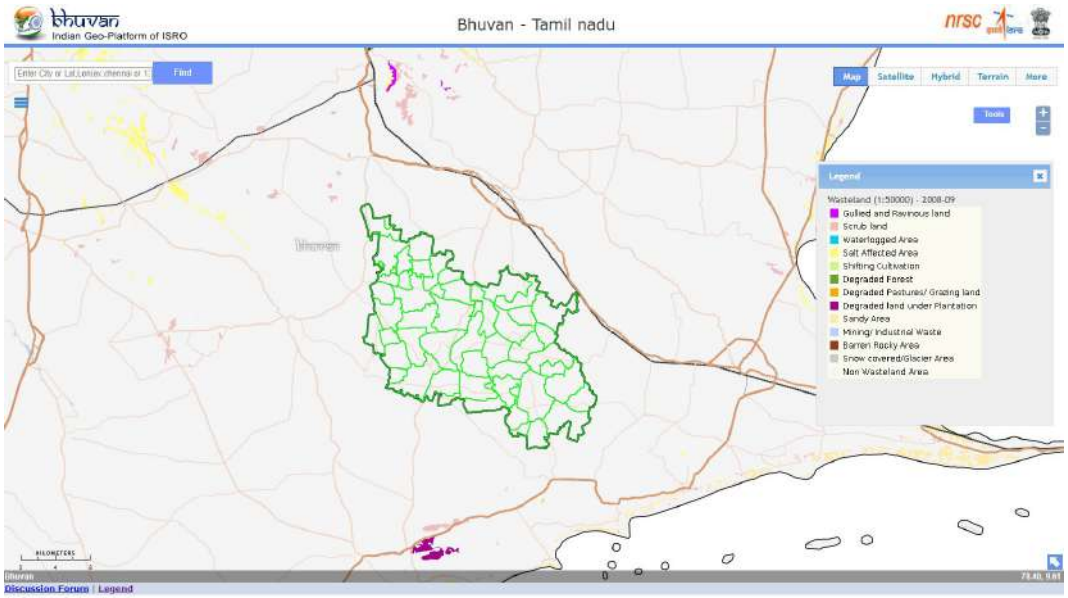


Figure 3.20. Wasteland map

Wasteland type	Area in %	Gram Panchayat
Saline - Moderate	48%	Periya Ilai - 90%, Athakothangudi - 85%, Arapodhu - 70%, Keelakanjirankulam - 50%, Selvanayagapuram - 20%, Kumarakurichi, Srn Palangulam - 10%

3.6.1.5 Salt affected area: TDue to the Block's proximity to coastal region, sodic and sodic-saline affected land is witnessed in the Block, same was also found in the results of salinity analysis of water samples (Figure 3.21). GP-wise details of salt affected area is shown in the illustration below. These parcels will act as a direct input in the planning process to propose soil conservation measures, mainly activities to reduce salinization and suggestions for alternative cropping.

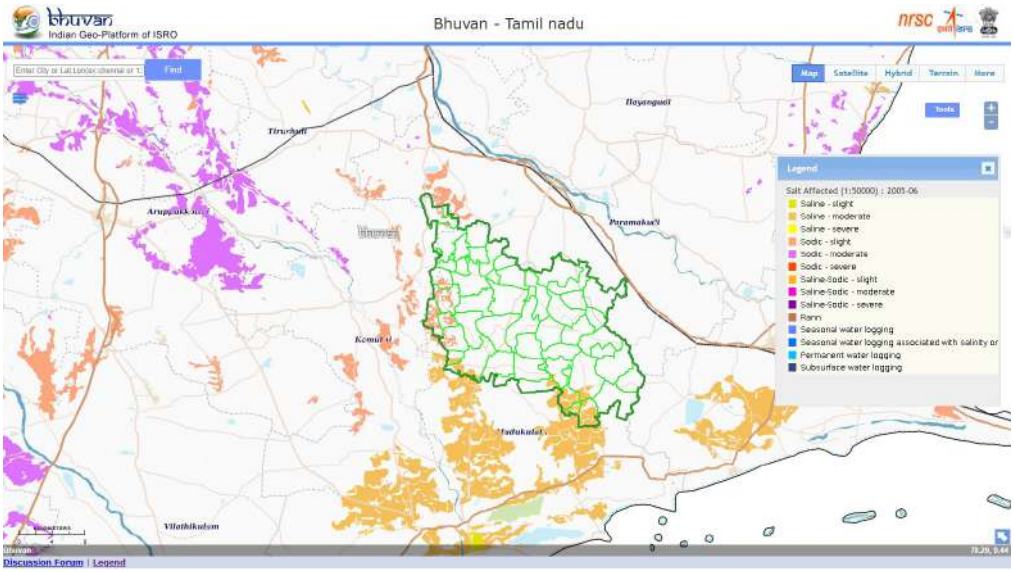


Figure 3.21. Salt affected area

Thematic unit	Area in %	Gram Panchayat
Saline - Slight	41%	Melakaniseri - 80%, Nallur - 65%, Manaloor - 50%, Athikulam - 45%, Vilakkanendhal - 40%, Melakodumalur, Nallukuruchi - 5%

3.6.2 NON SPATIAL DATA

Agriculture based non-spatial secondary data related to land resources, catchment, crop type, soil micro-macro nutrient, moisture, ET and livestock data were collected from govt. sources (Table 7). The key CWRM parameters of agriculture area for all GPs are tabulated in Annexure 3.10.

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

Key parameter	Extent
Area under Land Resources (ha.)	
Non-Agricultural Uses	6,812.66
Area under Barren & Un-cultivable Land	230.70
Area under Permanent Pastures and Other Grazing Land	16.00
Land Under Miscellaneous Tree Crops etc.	1,367.42
Cultivable Waste Land	531.27
Fallows Land other than Current Fallows	2,688.74
Current Fallow land	3,038.48
Unirrigated Land	16,556.85
Area Irrigated by Source	5,578.66
Land under Catchment Area (ha)	
Good Catchment	7,043.36
Average Catchment	1,914.69
Bad Catchment	27,862.73
Crop Details	
Irrigated Area (ha)	7,487.94
Rainfed area (ha)	21,450.64
Paddy Cultivation (ha)	24,234.40
Crop Water Requirement - Irrigated condition (ha.m)	10,619.57
Crop Water Requirement - Rainfed condition (ha.m)	19,778.55
Soil Resources: Status of Available Nitrogen (%)	
Very Low	54.91
Low	42.14
Medium	2.26
High	0.61
Very High	0.08
Status of Organic Carbon (%)	
Very Low	30.33
Low	22.45
Medium	6.38
High	11.03
Very High	29.80
Status of Soil Micro Nutrients (%)	
Sufficient	65.30
Deficient	34.70
Status of Physical condition of the soil (%)	
Moderately Acidic	0.10

Highly Acidic	0.79
Moderately Acidic	12.79
Slightly Acidic	11.28
Neutral	2.59
Moderately Alkaline	66.65
Strongly Alkaline	5.80
Soil Texture (%)	
Fine Soil	74.28
Coarse loamy	15.67
Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture (ha.m)	5,101.38
ET Losses (ha.m)	12,276.88
Means of Water Extraction (%)	
Gravity	43.17
Lifting	56.78
Irrigation Methods (%)	
Wild Flooding	79.20
Control Flooding	20.85
Livestock (No.)	
Cattle Population	3,686
Sheep Population	27,830
Goat Population	25,361
Poultry	25,574

3.6.2.1 Land utilization

The standard land use classification helps to understand the distribution and the extent of different land use categories. As the runoff and water harvesting actions are linked to the land use systems, its distribution across the geographical boundary of the Block is necessary to take decisions. Of the total land area of 36,820.78 ha, the highest of 44.97 % land is unirrigated, followed by 18.97 % is under non-agricultural uses, while less than a percent of barren & un-cultivable land and permanent pastures and other grazing land is found (Figure 3.22).

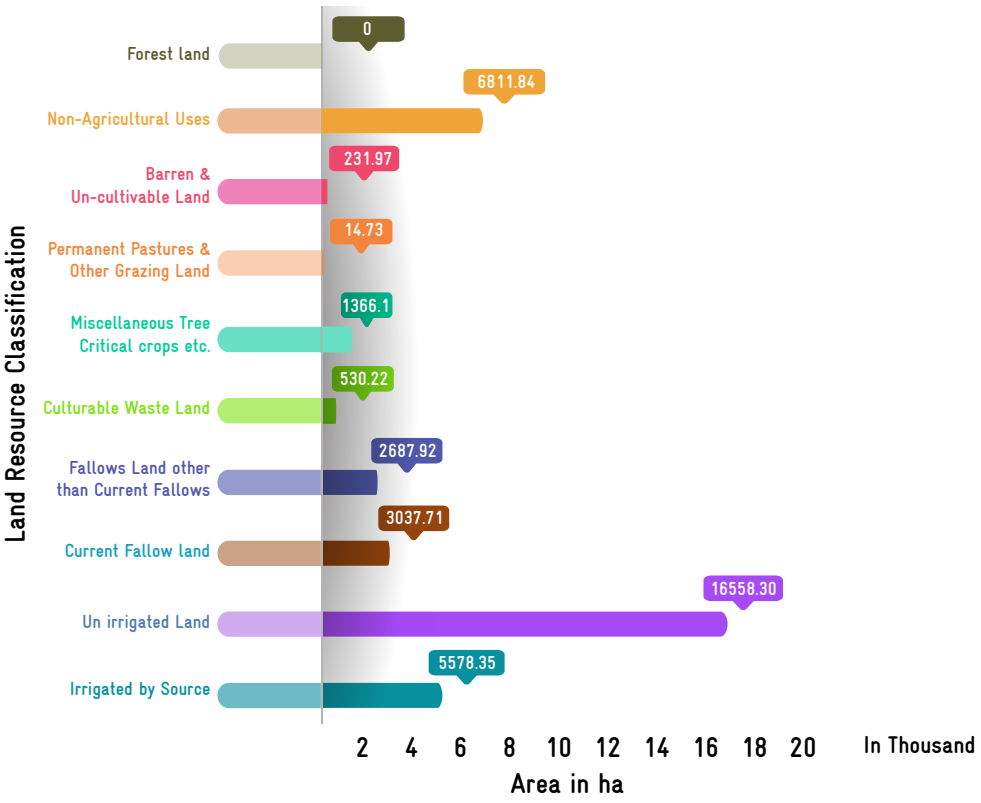


Figure 3.22. Land utilization

3.6.2.2 Catchment Area

The land use types in each of the GPs are categorized into three different types of runoffs; good, average and bad catchment area. Out of the total catchment area of 36,820.78 ha, of the Block, the highest of 75.67 % is from bad catchment area followed by 19.13 % from good catchment area and remaining is under average catchment area. This analysis helps to focus on prioritizing the works in the land use systems under the good and bad catchment areas (Figure 3.23).

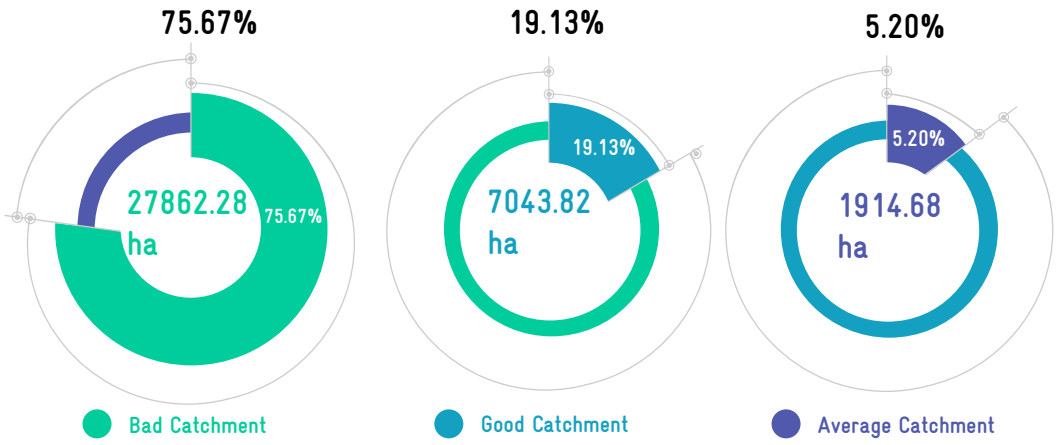


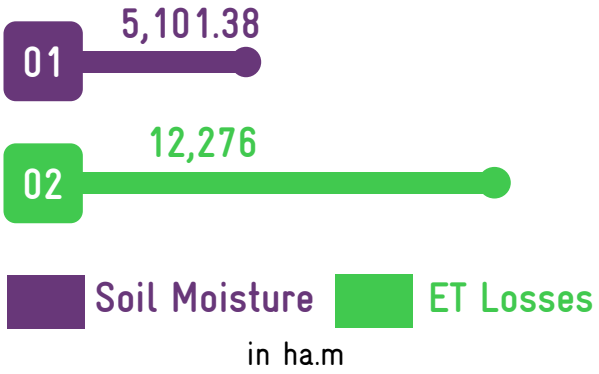
Figure 3.23. Catchment area

3.6.2.3 Soil moisture

Soil is an important medium to store the available water and the storage capacity varies with the type of soil especially its textural composition. In overall composite water budgeting, estimation of stored water in the soil assumes greater significance in this Block because of its significant proportion of area under rain-fed cultivation. The annual average volumetric soil moisture of this Block (17%), is taken for estimating the amount of water stored as soil moisture which accounts to 5,101.38 ha.m

3.6.2.4 ET losses

The transformation of liquid state of water state from earth surface to vapour state of water to atmosphere is the ET loss. The loss of water through ET is important in water budgeting. The Block area witnessed an annual total ET loss of 12,276 ha.m during 2018-19, with a monthly average of 799 ha.m.



3.6.2.5 Macro-nutrients
Nitrogen

The available nitrogen is very low in 54.91 % tested samples while high for 0.61 % samples (Figure 3.24). According to soil resource map, this Block is identified as one of the Nitrogen deficient Blocks (Ramanathapuram District profile 2020).

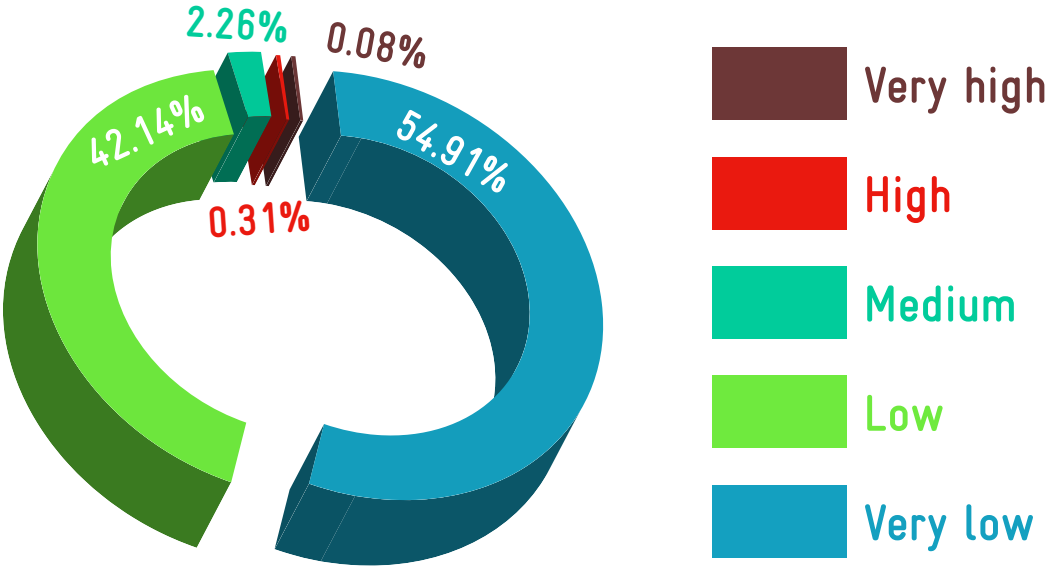


Figure 3.24. Status of available Nitrogen

Organic Carbon

Soil organic carbon ranges between very low and very high in the tested soil samples. 30.33 % of the soil samples tested fall under low category followed by 29.80 % falls under very high category while less of 6.38 % samples are witnessed with medium organic carbon (Figure 3.25). This indicates that the soil fertility is above average.

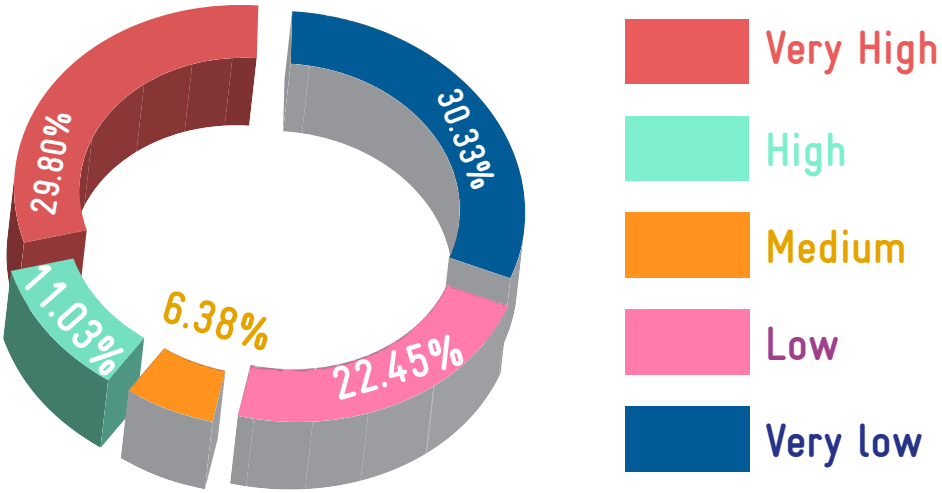


Figure 3.25. Status of soil Organic Carbon

3.6.2.6 Status of the soil micro-nutrients

This Block is one of the Nitrogen, Zinc and Ferrous deficient Blocks of Ramanathpuram District. The micro-nutrient status of the soil with specific reference to Manganese, Boron and Zinc, Ferrous, Copper, and Sulphate are deficient in 34.70 % and 65.30 % sufficient in the soils tested (Figure 3.26).

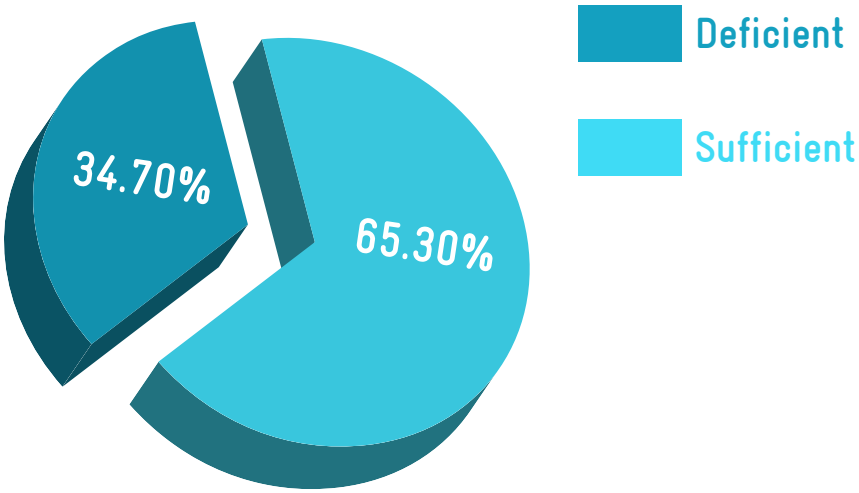


Figure 3.26. Status of soil micro-nutrients

3.6.2.7 Physical parameters – pH status

With reference to the physical parameters, 66.65 % of the soil is moderately alkaline in nature followed by 12.79 % is moderately acidic while 0.75 % is neutral (Figure 3.27).

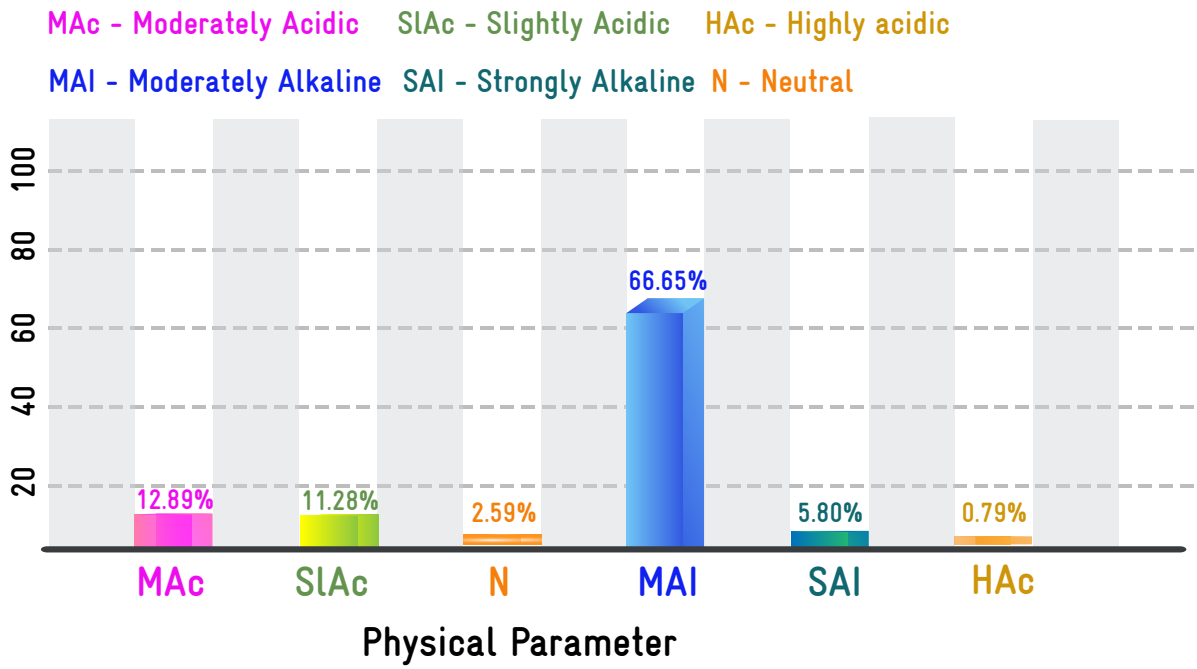


Figure 3.27. Status of pH of soil

3.6.2.8 Cropping pattern and irrigation

A total area of 28,938.58 ha is used for crop cultivation in which 74.12 % area is rainfed agriculture and the rest or the area is cultivated using irrigation sources. Paddy is a dominant crop in both water source field which accounts of 87.26 % followed by dry chilli of 10.73 % while cultivation of minor millets, ragi, coconut, garlic, jowar, other pulses, sugar cane, maize, guava, brinjal, soybean accounts to less than one percent of the cultivated area.

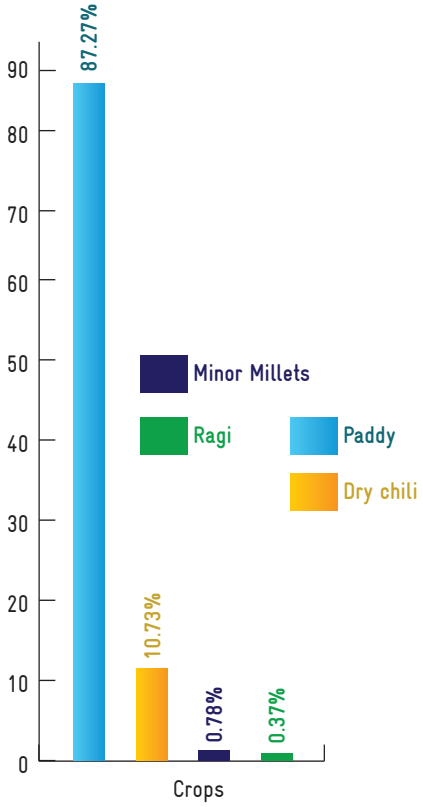


Figure 3.28. Crop pattern (including rain-fed and irrigation area)

3.6.2.9 Irrigation methods

In case of the surface water resources, wild flooding is the primary method of irrigation. But in case of ground water resources, the predominant type of irrigation is control flooding. In the Block, 79.20 % of the irrigation is done by wild flooding and rest of irrigation is done by control flooding (Figure 3.29).

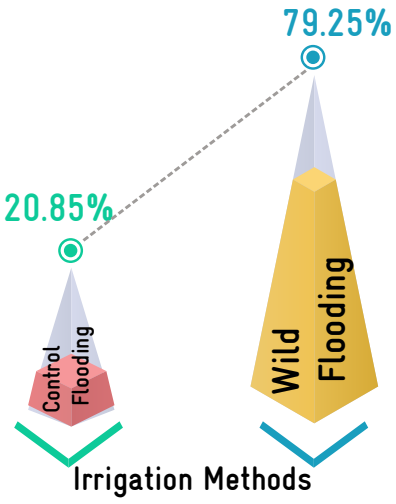


Figure 3.29. Irrigation methods

3.6.2.10 Means of water extraction

Water is extracted in two ways, one by gravity and the other is by lifting. Water is drawn from surface water sources such as tanks, ponds etc., by using gravity method and that of ground water sources such as open well, hand pump, bore well by using lifting method. In the Block, 43.17 % of the water extraction is through gravity and rest comes under lifting means of water extraction (Figure 3.30).

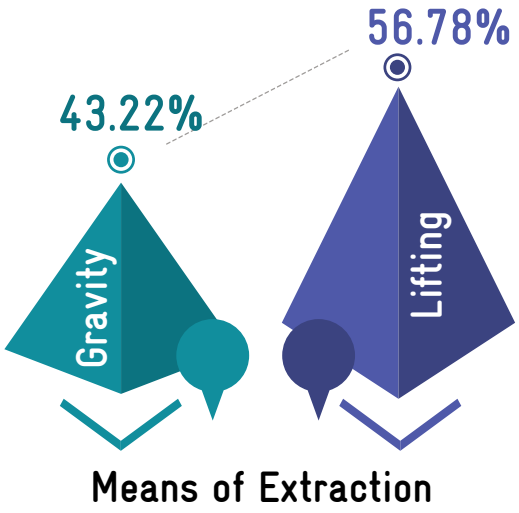


Figure 3.30. Means of water extraction

3.6.2.11 Livestock details

This Block has considerable proportion of livestock resources about 82,451. Of which small ruminants sheep populations is high 33.75 % (27,830) followed by poultry of 31.02 % (25,574) and 30.76 % of goats (25,361), while cattle population is about 4.47 % (3,686) (Figure 3.31). The total water requirement for livestock is 60.04 ha.m. Of the total water demand of 56.78 % is met through surface water and remaining is from ground water resources.

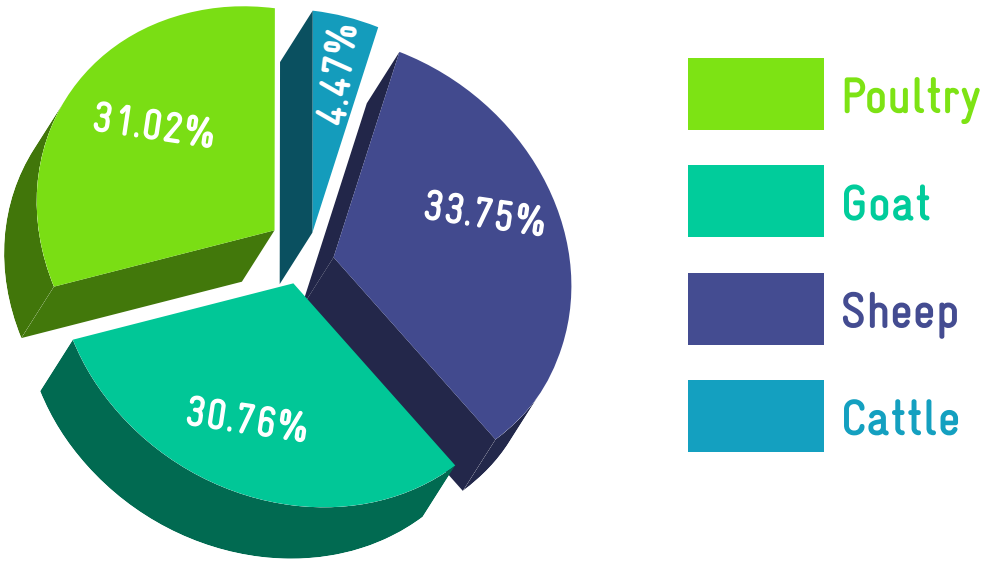


Figure 3.31. Livestock details

3.7 CWRM PLANNING ANALYSIS- SOCIO-ECONOMIC

The demographic details such as population, gender, vulnerable population/ households, drinking and grey water details are collected from authentic primary and secondary sources and analyzed. Data of MGNREGA job holders is also taken for the analysis. Table 8 lists the demographic and socio-economic status of Mudukulathur Block. GP wise demographic and socio-economic status are attached in Annexure 3.11.

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

Parameter	Total
Geographical Area (ha)	38,189
Male Population (No.)	60,261
Female Population (No.)	60,804
Total Population (No.)	1,21,065
SC Population (No.)	36,536
ST Population (No.)	5
Vulnerable population (No.)	36,541
Households (HH's) (No.)	31,620
Only one room HH's (SECC) (No.)	4,204
Female Headed HH's (SECC) (No.)	2,637
Vulnerable Households (SECC) (No.)	3,355
Vulnerable Households (%)	13
Registered MGNREGA Job cards (Persons)	34,223
Active person working in MGNREGA job Cards (Persons)	26,674
Drinking Water Sources (No.)	2,826
HH's have tap water connection for drinking water (No.)	16,473
HH's dependent on other sources for drinking water (No.)	16,748
Annual Greywater Generation (ha.m)	221

3.7.1 Population:

The total population of this Block is 1.21 Lakhs* in which the female proportion is slightly higher than male population. In the CWRM planning process, due attention is given for the intersecting variables such as gender, class, caste and marital status and availability of safe drinking water resources. In the Block, about 30.18 % of the total population are under vulnerable population (Figure 3.32).

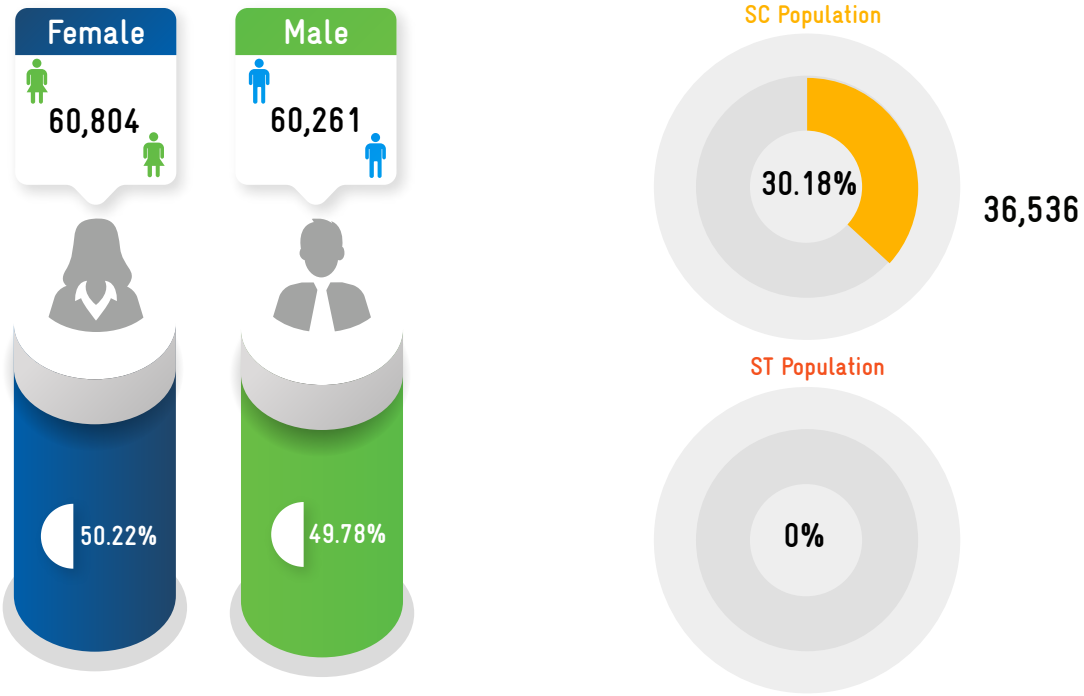


Figure 3.32. Population details

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

3.7.2 Details of households

There are a total of 31,620 households in which 13.30 % households have only one room, 8.34 % households are headed by women and 10.61 % are vulnerable households (Figure 3.33)

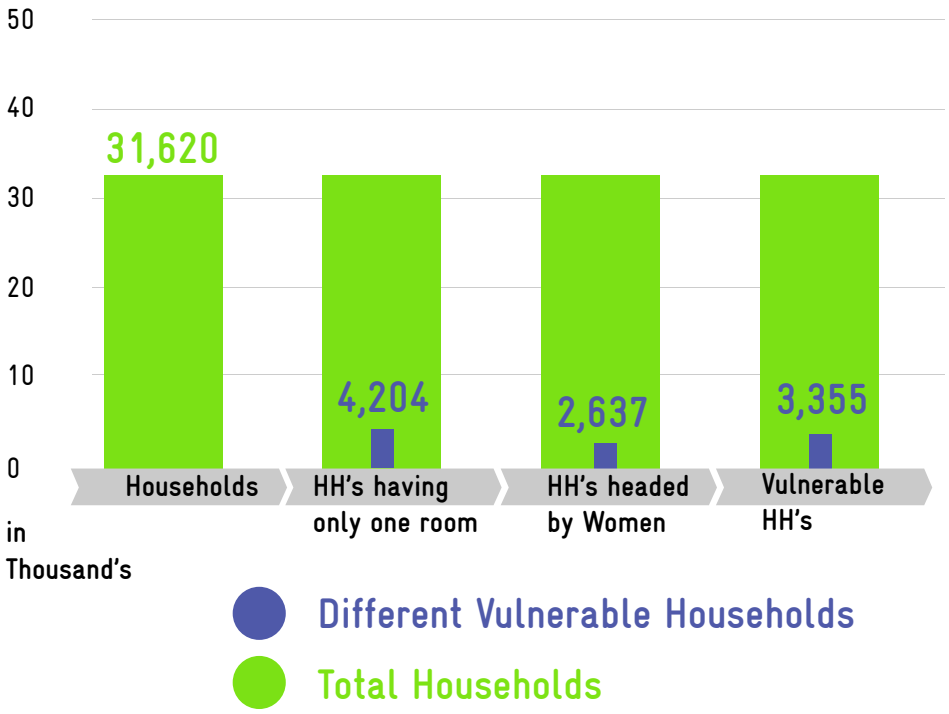


Figure 3.33. Details of households

3.7.3 Status of Mahatma Gandhi NREGA - job card status

In the Block, of the total population of 1.21 Lakhs, 34,223 are registered for job cards in Mahatma Gandhi NREGA scheme in which 78 % of the job cards are in active category (Figure 3.34)

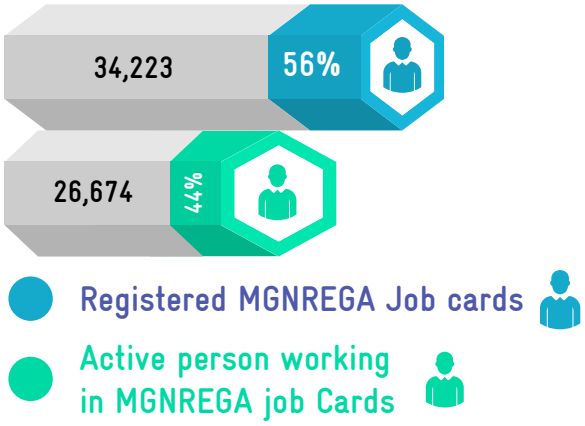


Figure 3.34. Status of MGNREGA job cards

3.7.4 Drinking Water Sources

Nearly 16,473 households have tap water connection and 16,748 households depend on other water sources for domestic use, where other sources include RTRWHS / Tanka (roof rain water harvesting systems, hand pump, open wells, bore wells, tank/ pond/ oorani, springs and river/ streams.

Tap water connection

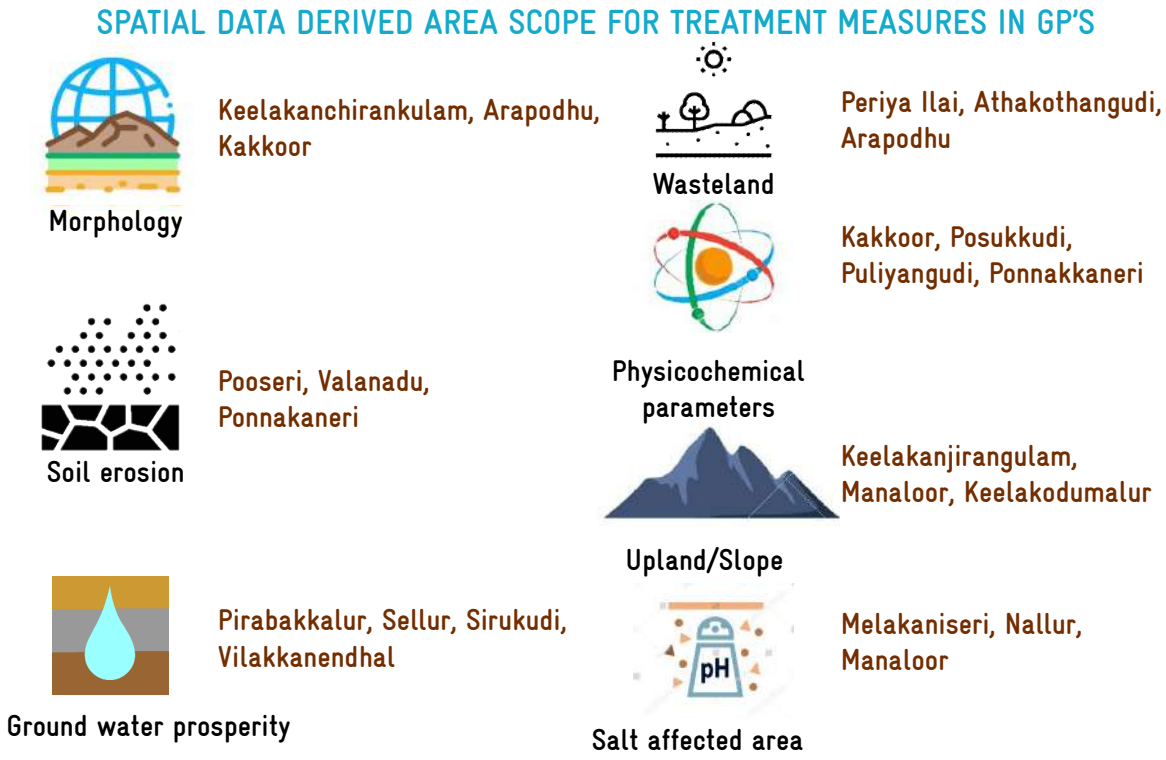
16,473
Households

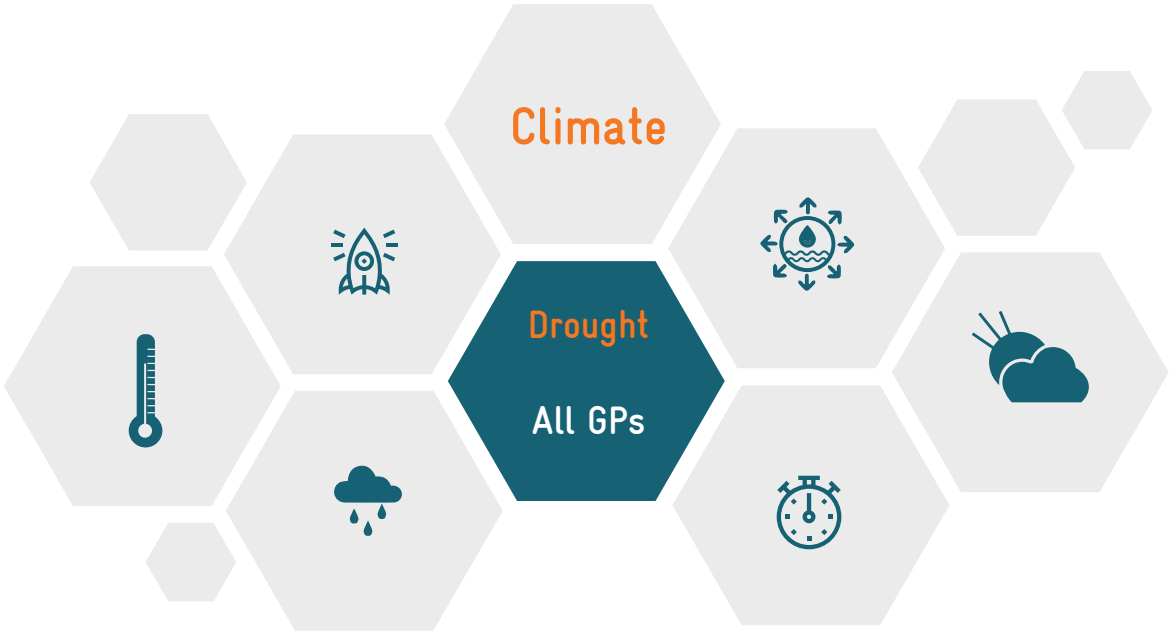
Other sources include RTRWHS / Tanka (Roof Rain Water Harvesting Systems), Hand pump, Open well, Bore well, Tank/ Pond/ Oorani, Springs and River/ Streams

16,748
Households

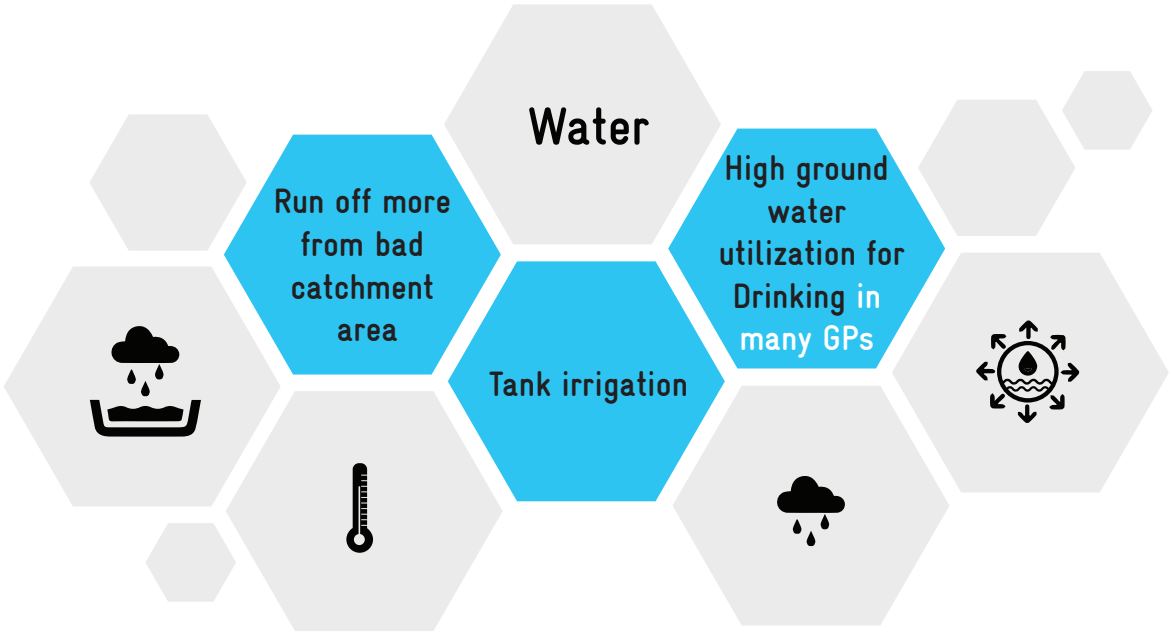
3.7.5 Annual Greywater Generation

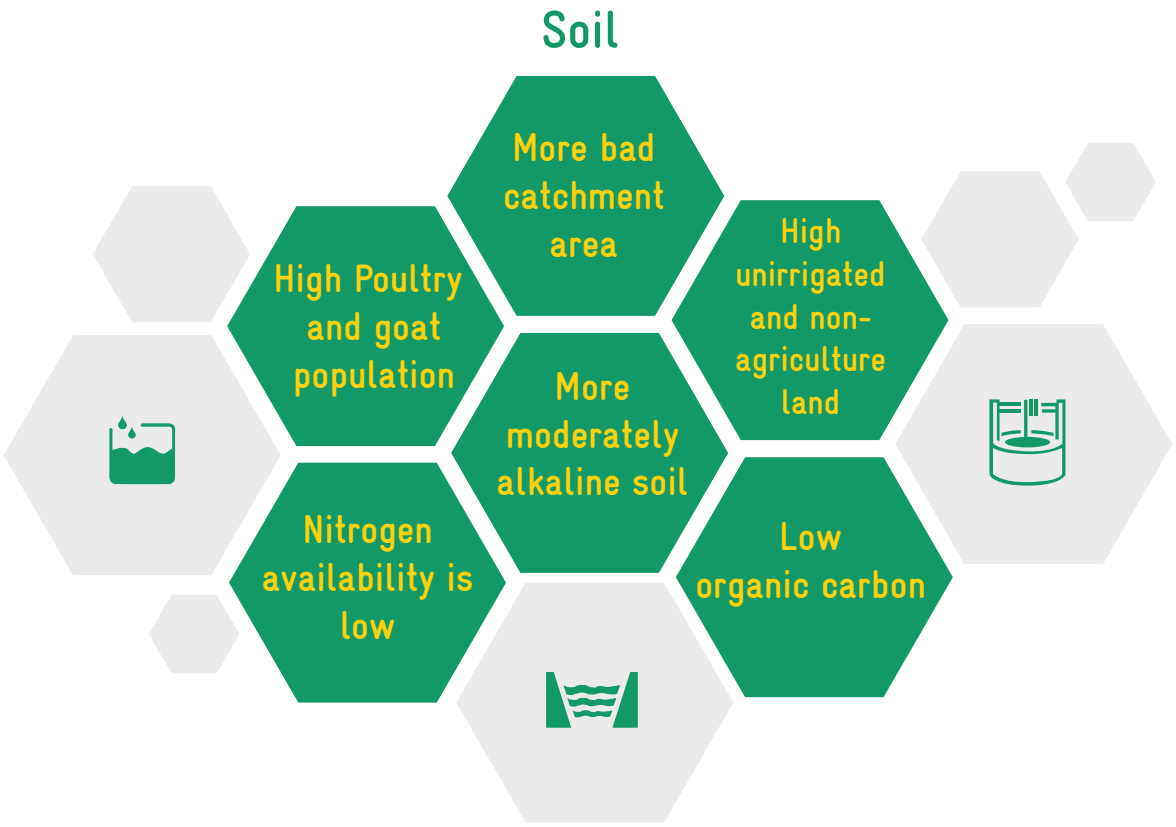
The grey water generation estimated across this Block is 221 ha.m which is available for reuse or recycle.





Socio economic


Water
Run off more from bad catchment area
High ground water utilization for Drinking in many GPs
Tank irrigation


Soil
More bad catchment area
High Poultry and goat population
High unirrigated and non-agriculture land
More moderately alkaline soil
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. Intergovernmental Panel on Climate Change (IPCC) defined Vulnerability as 'the propensity or predisposition to be adversely affected' (IPCC 2014). Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and the lack of capacity to cope and adapt. It is determined by sensitivity and adaptive capacity of the system (Figure 4.1).

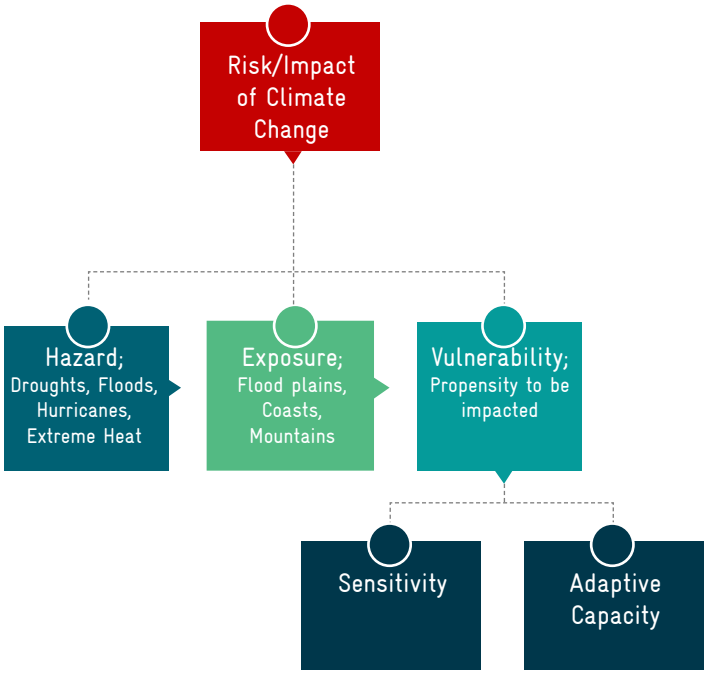


Figure 4.1. Vulnerability of the system as defined by IPCC

Generally, vulnerability assessments are made to identify.

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

The CWRM parameters which been explored through rigorous study were considered here to address the key water challenges at GP level. About 73 spatial and non-spatial parameters/ indicators under 4 dimensions via Climate (3), Water (28), Agriculture (31) and 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.

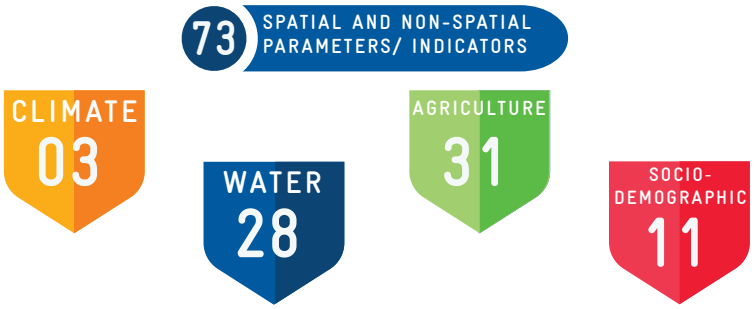


TABLE 9. CWRM PARAMETERS/INDICATORS SELECTED FOR BLOCK LEVEL VULNERABILITY

	Key CWRM Parameter	Vulnerability relationship
Climate	Drought	Climate risk/Sensitivity
	Flood locations	
	Heat Wave	
Water	**Canal Network (in m)**	
	Length of main canal	Adaptive capacity
	Length of minor canal	
	Length of distributaries	
	Water courses (Field channels)	
	Traditional water bodies (in No.)	
	No. of Tanks	Adaptive capacity
	No. of Ooranis	
	Other surface waterbodies	
	Irrigation Facilities (in ha)	
	Area under Tank irrigation	Sensitivity
	Area under canal irrigation	
	Area under open & tube well irrigation	
	Catchment Area wise Available Runoff (ha.m)	
	Good Catchment Area	Sensitivity
	Average Catchment Area	
	Bad Catchment Area	
	Watershed and Drainage Networks	
	Length of Natural Drainage Lines (m)	Adaptive capacity
	Number of Natural Drainage Lines	
	Number of Micro-watersheds	
	Water demand (ha.m)	
	For Humans	Sensitivity
	For Livestock	
	For Agriculture	
	% GW utilization for Drinking	
	% GW utilization for Livestock	
	% GW utilization for Agriculture	
	% SW utilization for Drinking	
	% SW utilization for Livestock	
	% SW utilization for Agriculture	
	Watershed and Drainage Networks	
	Water Quality Index	
	Sea Mixing Index	
	Salinity Index	
Agriculture	**Area under land resources (in ha)**	
	Forest land	Adaptive capacity
	Non-Agricultural Uses	
	Barren & Un-cultivable Land	
	Permanent pastures and Other grazing land	
	Land under miscellaneous tree crops etc.	
	Cultivable wasteland	

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

Socio economic	**Water accessibility (in %)**	
	HH's have tap water connection for drinking water	Adaptive capacity
	HH's dependent on other sources for drinking water	Sensitivity
	Annual Greywater Generation (in ha.m)	

The identified indicators are from different sources and measured in different units. As the vulnerability assessment is about ranking, the indicators have to be in common units. This is done through normalization. The normalized indicators are aggregated and categorized to different vulnerability levels very high, high, medium, low and very low category. The vulnerability assessment methodology is given in Annexure 4. The GPs categorized based on vulnerability scores are shown in Figure 4.2. Keelakanchirankulam, Posukudi, S.R.N Palangulam and Valandu GPs have very high rural water security vulnerability to climate risks followed by Pulithikulam, Athanakurichi, Thiruvarangam, Sembongudi, Theriruveli, Athikulam GPs with high vulnerability. Sathanur, Melakodumalur, Arapothu, Kathankulam, Keelathooval, Keeranoor, Karumal, Nallukuruchi, Kaakkor GPs have very low vulnerability.

Upto	Category	Color range
0.569	Very High	
0.545	High	
0.521	Medium	
0.497	Low	
0.473	Very low	

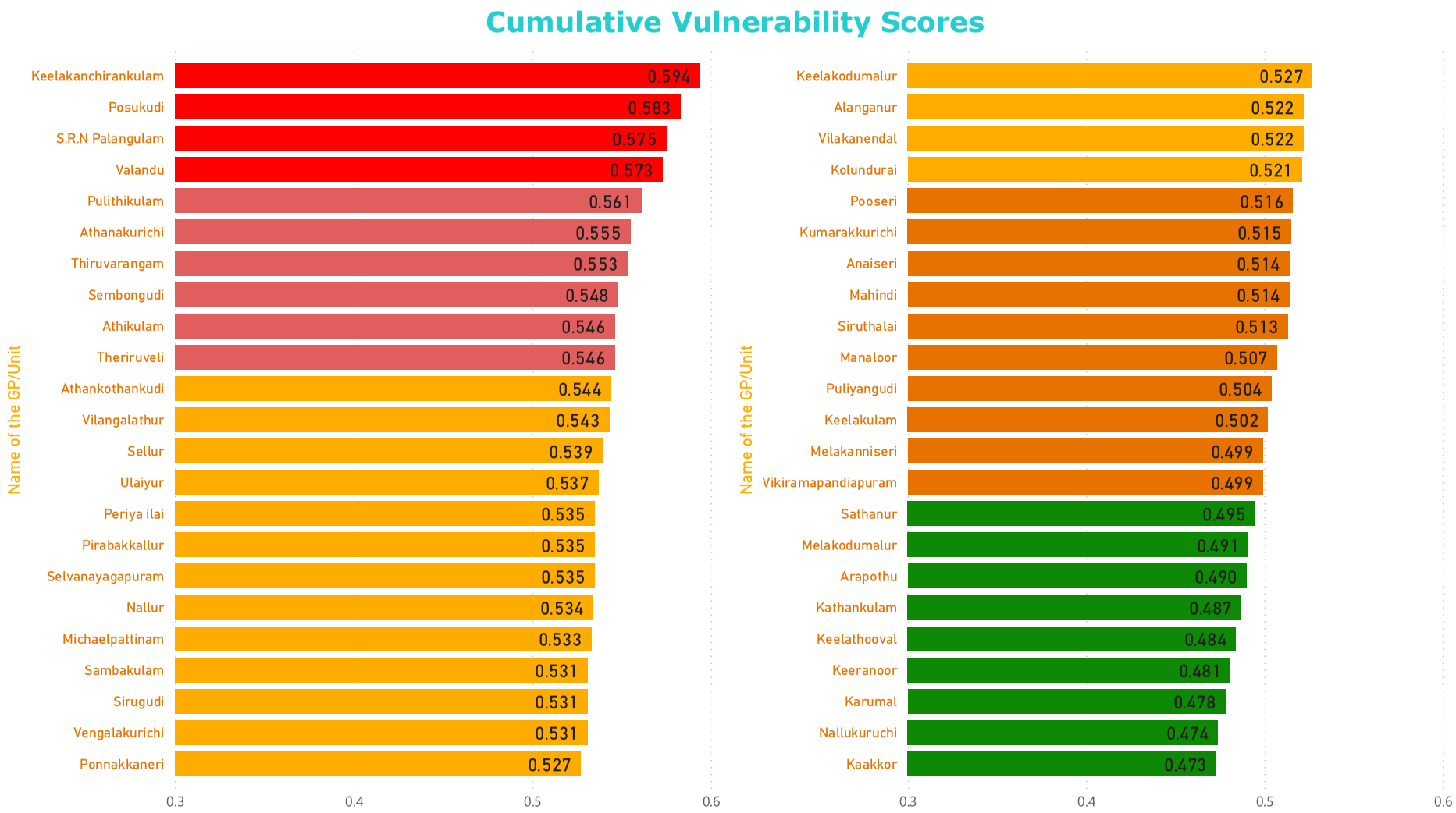


Figure 4.2. Final cumulative vulnerability scores

Sectoral vulnerability

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

Climate risks vulnerability

The climate risk vulnerability index shows that all GPs in this Block are affected with droughts in last decades.

ALL GPs

Water resource vulnerability

The water resources vulnerability index shows that Sellur, Vilangalathur, Sambakulam, Thiruvarangam, Valandu, Pooseri, Pulithikulam, Posukudi, Ulaiyur GPs have high vulnerability

SELLUR, VILANGALATHUR, SAMBAKULAM, THIRUVARANGAM, VALANDU, POOSERI, PULITHIKULAM, POSUKUDI, ULAIYUR

Agriculture resources vulnerability

In agriculture and allied sectors, Valandu, Selvanayagapuram, Keelakanchirankulam, S.R.N Palangulam, Nallur, Sirugudi, Kumarakkurichi, Posukudi GPs have high vulnerability

VALANDU, SELVANAYAGAPURAM, KEELAKANCHIRANKULAM, S.R.N PALANGULAM, NALLUR, SIRUGUDI, KUMARAKKURICHI, POSUKUDI

Socio-economic vulnerability

Keelakanchirankulam, Athankothankudi, Keelakulam, Periyailai, Keelakodumalur GPs have high socio economic vulnerability

KEELAKANCHIRANKULAM, ATHANKOTHANKUDI, KEELAKULAM, PERIYAILAI, KEELAKODUMALUR

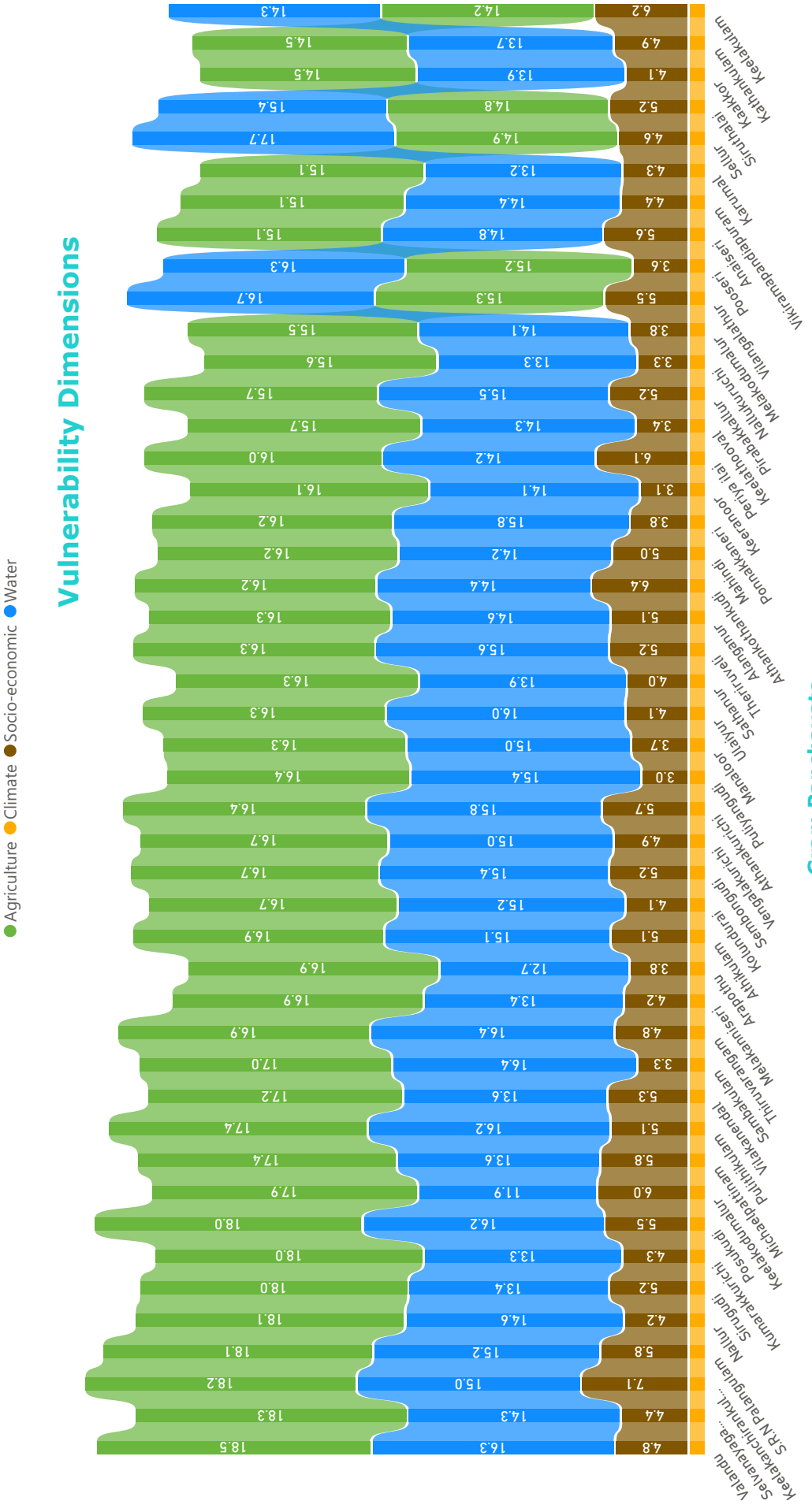
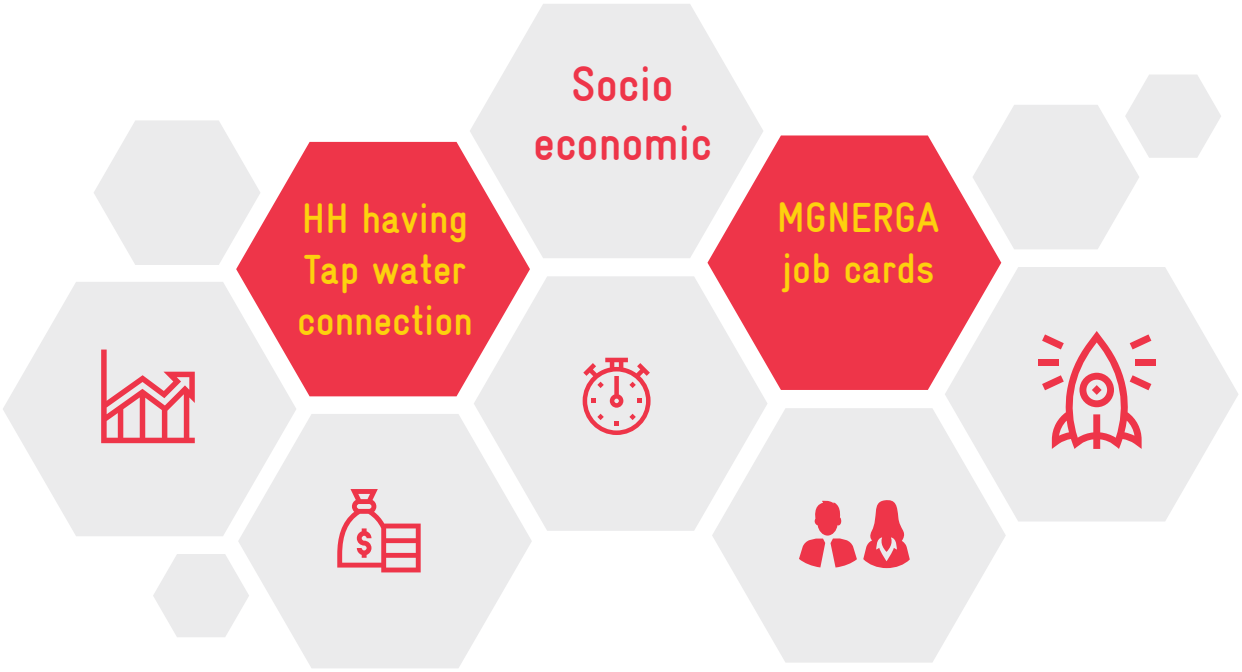
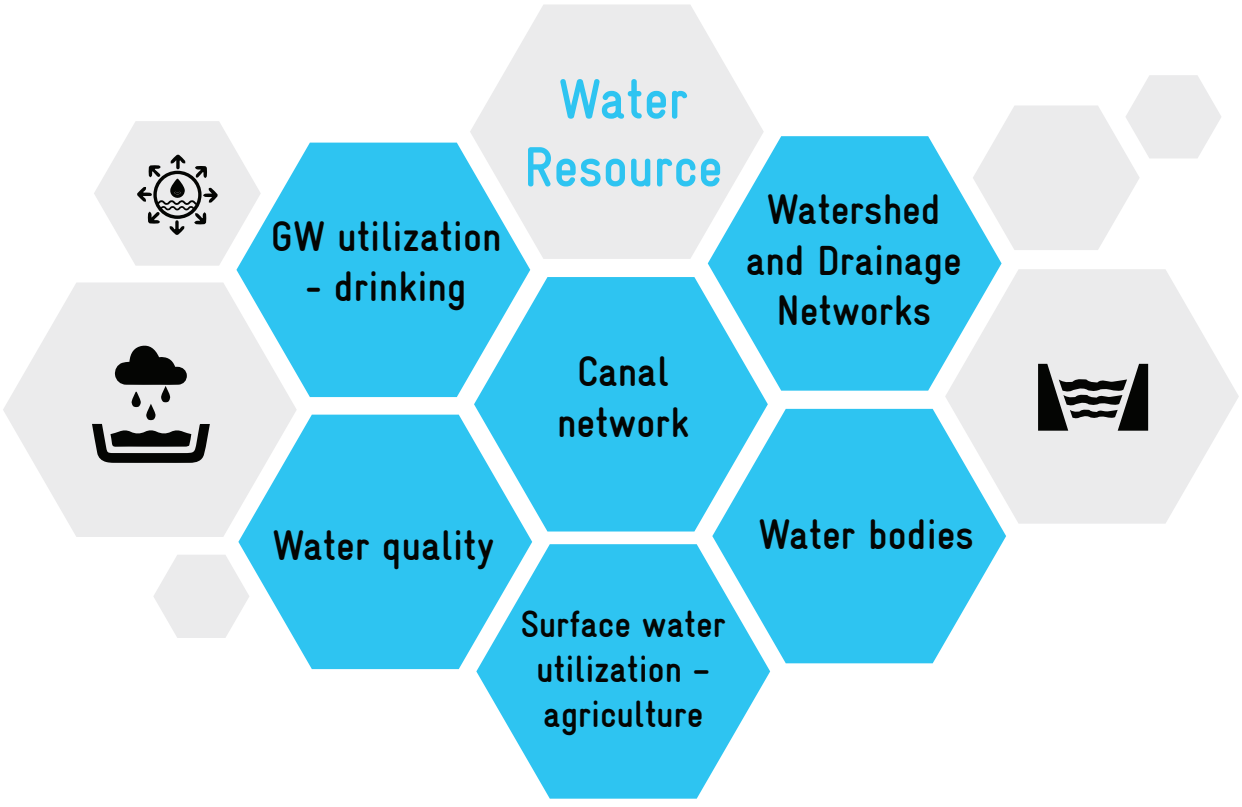
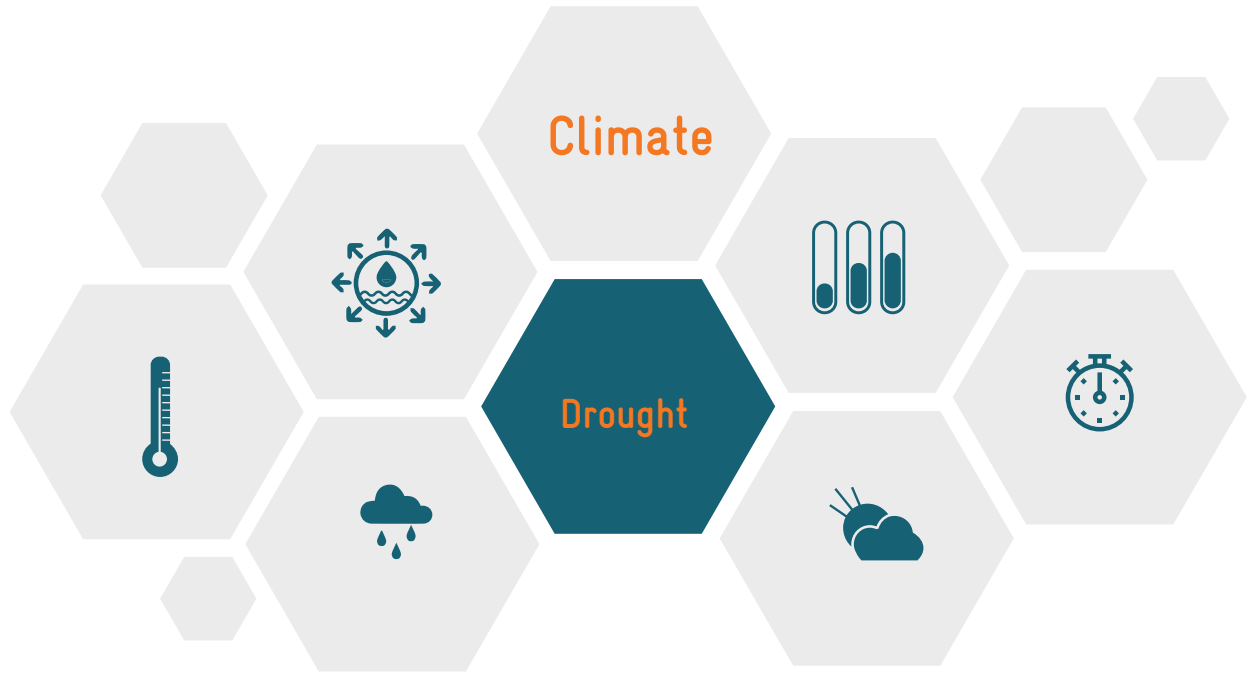


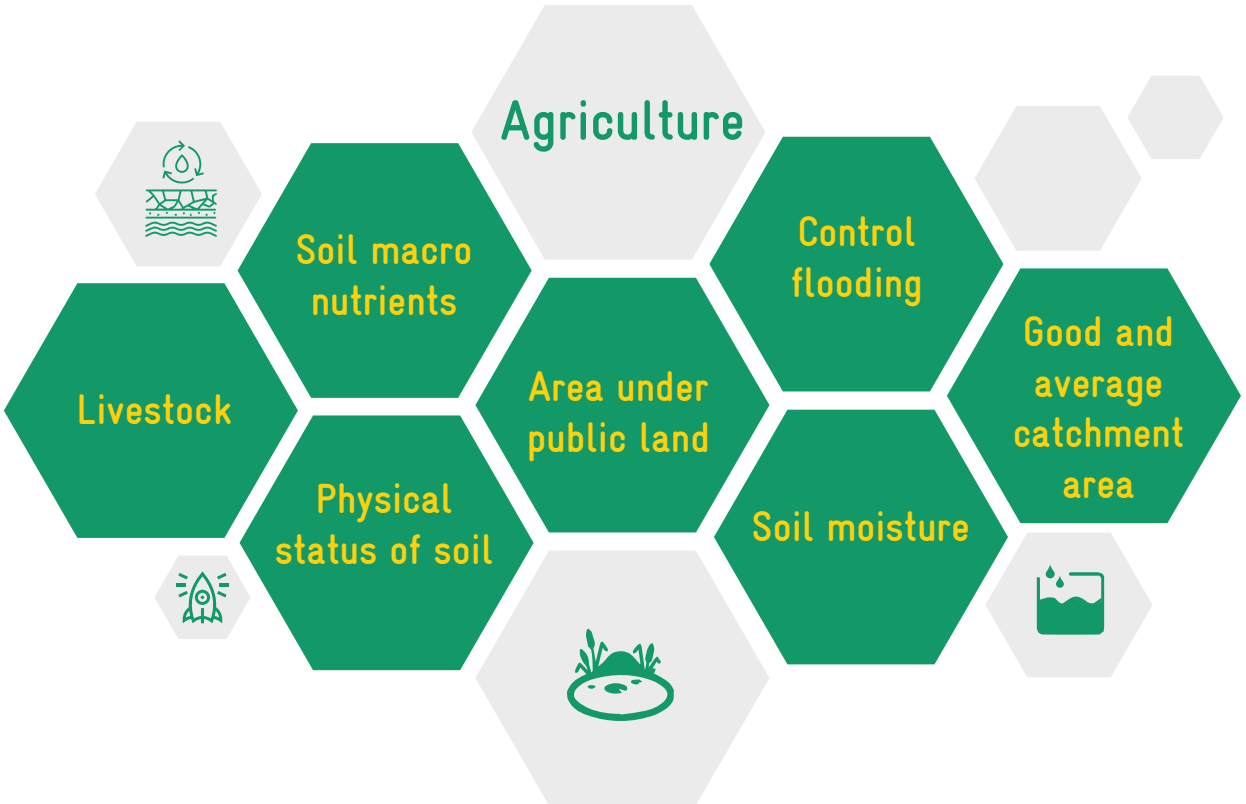
Figure 4.3. GP wise vulnerability dimensions

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 KEY WATER ACTIONS IN MUDUKULATHUR BLOCK 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 enable to identify water action works in public and common land (afforestation, soil and water conservation, improving the traditional water storage and catchment assets etc.,), agriculture and allied sector (farm ponds, artificial recharge structures, on-farm plantation, irrigation methods, livestock - fodder development etc.,) and rural infrastructure (on safe drinking water and efficient handling of grey water).

PROPOSED AREA UNDER WASCA TREATMENT

Out of 37,635.84 ha available land in Mudukulathur Block, 4,318.15 ha (11.73 %) area is proposed for treatment under WASCA TN– CWRM planning. A major portion of Key Water Actions is proposed in 1,382.81ha of land of unirrigated (32.02 % of total proposed area), followed by 1,162.29 ha of land under miscellaneous tree crops etc. (26.92 % of total proposed area) while least of 13.6 ha area permanent pastures and other grazing land was considered for treatment. The detailed land wise proposal for WASCA treatments is given in the Table 10 and Figure 5.1. GP wise proposed area for treatment is also attached in Annexure 5.1.

TABLE 10. THE PROPOSED AREA FOR WASCA TREATMENT

Land use	Total available land (ha)	WASCA proposed treatment area (ha)
Unirrigated Land	16,556.85	1382.81
Land Under Miscellaneous Tree Crops etc.	1,367.42	1162.29
Area Irrigated by Source	5,578.66	498.69
Cultivable Waste Land	531.27	451.61
Current Fallow land	3,038.48	225.6
Fallows Land other than Current Fallows	2,688.74	198.58
Barren & Un-cultivable Land	230.70	196.1
Non-Agricultural Uses	6,812.66	188.87
Area under Permanent Pastures and Other Grazing Land	16.00	13.6

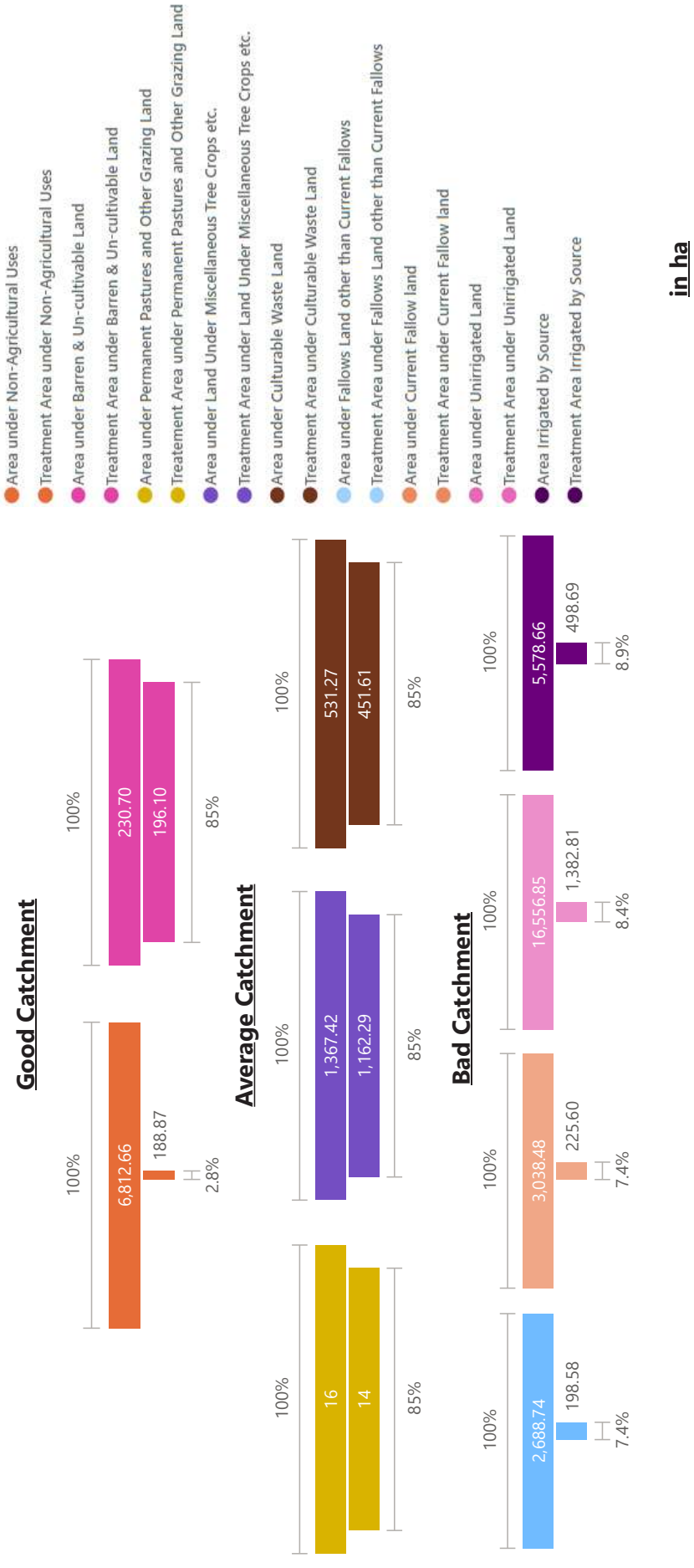


Figure 5.1. WASCA treatment area in percentage

Expected Runoff Conservation after WASCA treatment

The productive developmental activities that were taken up in the WASCA proposed areas are termed as Key Water Actions. With the above proposed treatment area, the expected runoff harvested due to WASCA intervention would be around 1451.22 ha.m which is 28.71% of the total runoff. Of the expected runoff conservation, the highest of 61.41% from good catchment area followed by 19.60 % from average catchment area and rest is from bad catchment area (Figure 5.2).

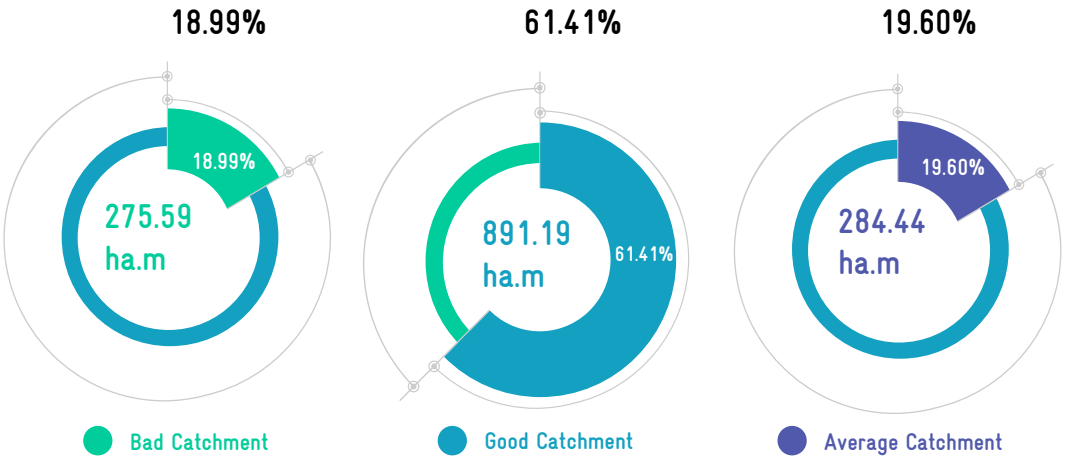


Figure 5.2. Expected conservation after WASCA treatment

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

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

Work (unit)	Abbreviation (unit)	No.	Extent (area in ha or length in m)
Azolla units - Individual (Number of units)	Az	79	788
Cattle Shelters (Number of units)	CS	79	788
Cattle Trough(Number of units)	CT	79	788
Fodder development - Community & Individual	FD	79	788
Goat Sheep Shelters (Number of units)	GSS	3,012	30,073
Poultry Shed (Number of units)	PS	568	5,655
Silvi-pasture Development (ha)	SPD	10,880	14
Soak Pits (Community) (Number of units)	SPC	292	29,110
Soak Pits (Individual) (Number of units)	SPI	2,910	29,110
Artificial Recharge Structure(Number of units)	ARS	680	1,706
Construction of Farm Ponds - Individual (Number of units)	FP	673	2,149

Restotaration of water bodies:a.PWD and Tanks(Number)	RPWDT	170	
Restotaration of water bodies:b. Ooranis(Number)	Roo	352	
Restotaration of water bodies:c. Ponds(Number)	RP	-	
Roof Rain Water Harvesting (Number of units)	RRWH	84	
Water Course - Irrigation Channels - Desilting (Mtrs)	WCICD	39,457	
Afforestation in Public/common lands(ha)	Aff	2,94,134	368
Avenue plantation(km)	AVP	49,986	1,99,934
Block Plantation (Community)(ha)	BP	12,09,408	1,525
Canal Bund Plantation(ha)	CBP	29,813	1,19,237
Contour Continous Bunds (CCB) for Afforestaion area(Mtrs)	CCBF	73,537	368
Drainage Line Treatment (Mtrs)	DLT	7,297	29,184
Dry land Horticulture/Agro-forestry - Individual (ha)	DLHAI	433	1,076
Irrigation Channel Plantation (Mtrs)	ICP	9,868	39,457
Linear Plantation(km)	LP	16,850	67,401
Micro Irrigation(ha)	MI	189	470
Nursery Development (Number of units)	ND	1,45,550	29,110
Composting(Number of units)	Co	673	2,149
Farm Bunding with Boundary Trenches - Individual (ha)	FBBTI	858	2,149
Land development - Individual (ha)	LDI	333	839
NADEP Vermi compost (Number of units)	NADEP	79	788


Proposed works are included the drought proofing, livelihood, land development and WCWH, measures
Land development works over 5,925 ha area
More than 18 Lakhs plants planting
1,959 sites for WCWH
17,900 livelihood works

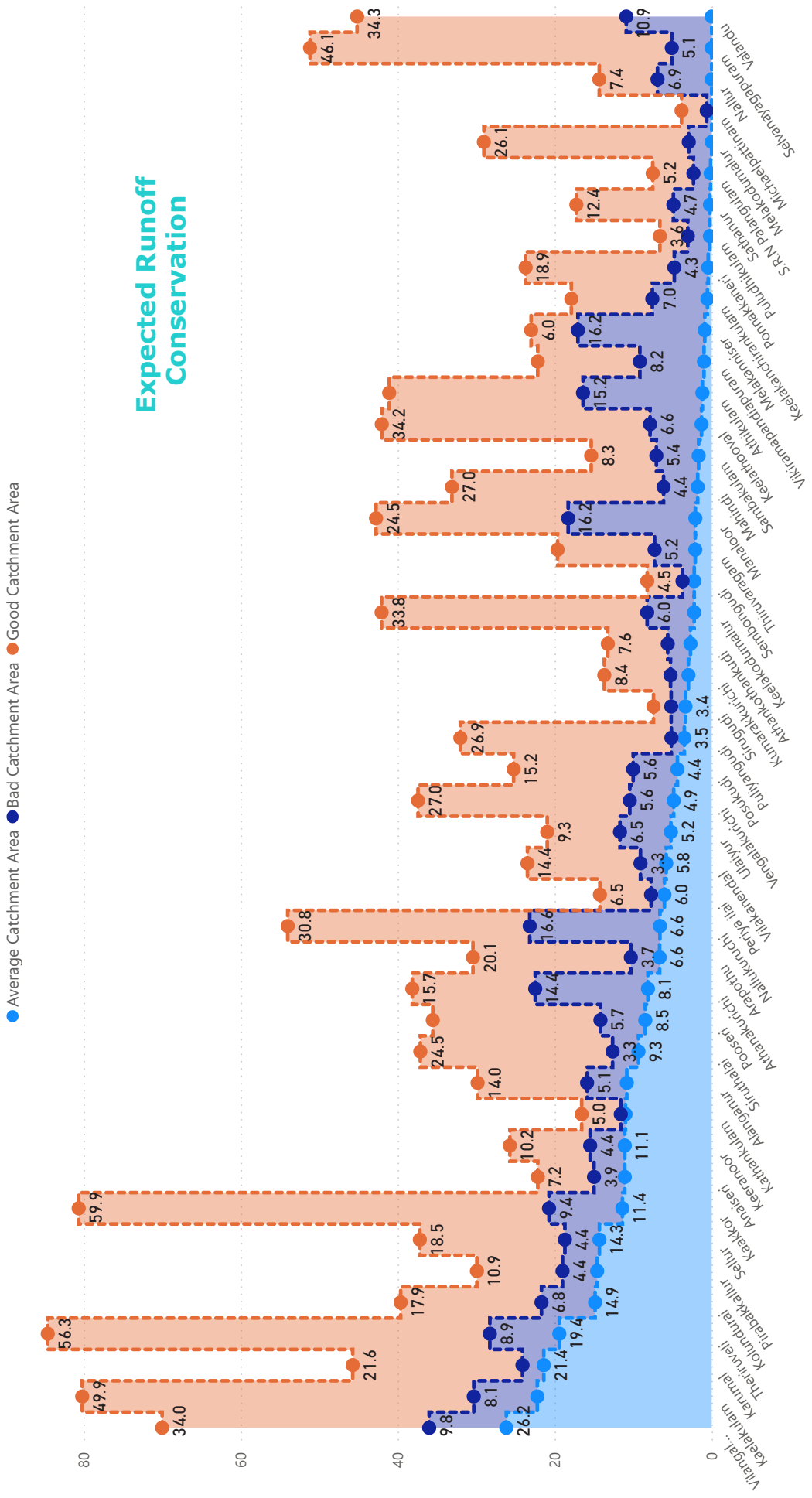


Figure 5.3. Expected GP wise runoff conservation after WASCA treatment

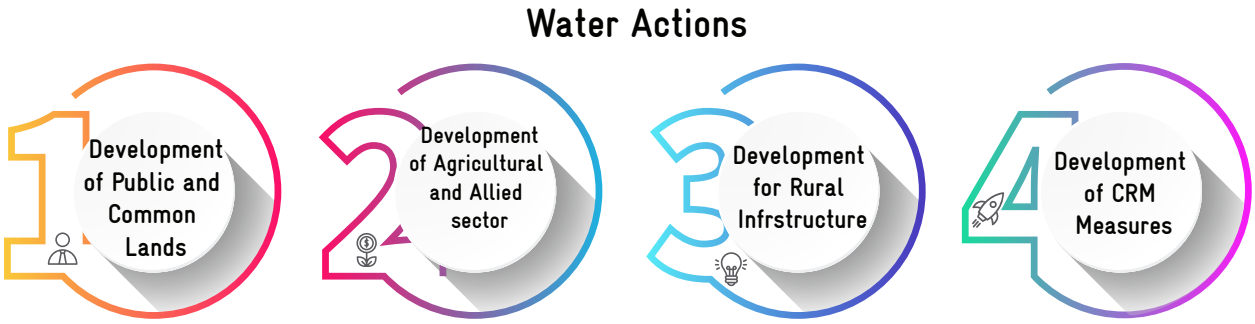
MAHATMA GANDHI NREGS Annual circular 2020-21 (Clause 6.3)

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



5.1 DEVELOPMENT OF PUBLIC & COMMON LANDS

The effective water augmentation measures are proposed in public and common lands via massive tree plantation, restoration of waterbodies etc., as listed in Table 11 and Figure 5.4.

DEVELOPMENT OF PUBLIC AND COMMON LANDS

TABLE 11. DETAILS OF WORK PROPOSED TO DEVELOP PUBLIC AND COMMON LANDS

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
CONTOUR CONTINUOUS BUNDS FOR AFFORESTATION AREA (m)	1,471	10	36.77	75.92	14,707
COMPOSTING (NUMBER OF UNITS)	673	15	114.41	139.74	10,095
AFFORESTATION IN PUBLIC/ COMMON LANDS (ha)	368	3,344	3,164.80	6,527.40	12,30,592
BLOCK PLANTATION (COMMUNITY) (ha)	1,525	4,320	16,927.50	6,537.90	65,88,000
SILVI-PASTURE DEVELOPMENT (ha)	14	6,664	239.40	51.3	93,296
LINEAR PLANTATION (km)	67	703	121.32	170.82	47,382
CANAL BUND PLANTATION (ha)	246	2,930	1845.98	1,965.08	7,21,161
IRRIGATION CHANNEL PLANTATION (m)	20,408	6	306.12	244.74	1,22,448
AVENUE PLANTATION(km)	200	703	359.88	268.56	1,40,554
NURSERY DEVELOPMENT (NUMBER OF UNITS)	728	2,344	10,916.25	7,707	17,05,846
RESTOTARATION OF WATER BODIES: PWD AND UNION TANKS (NUMBER)	157	800	785	1,135	1,25,600
RESTORATION OF WATER BODIES: OORANIS (NUMBER)	288	200	576	792	57,600
RESTORATION OF WATER BODIES: PONDS (NUMBER)	-	200	-	12	-
ARTIFICIAL RECHARGE STRUCTURE (NUMBER OF UNITS)	211	391	527.50	410	82,501
WATER COURSE - IRRIGATION CHANNELS - DESILTING (M)	20,408	3	153.06	122.37	61,224
DRAINAGE LINE TREATMENT (m)	730	5	21.89	57.24	3,649

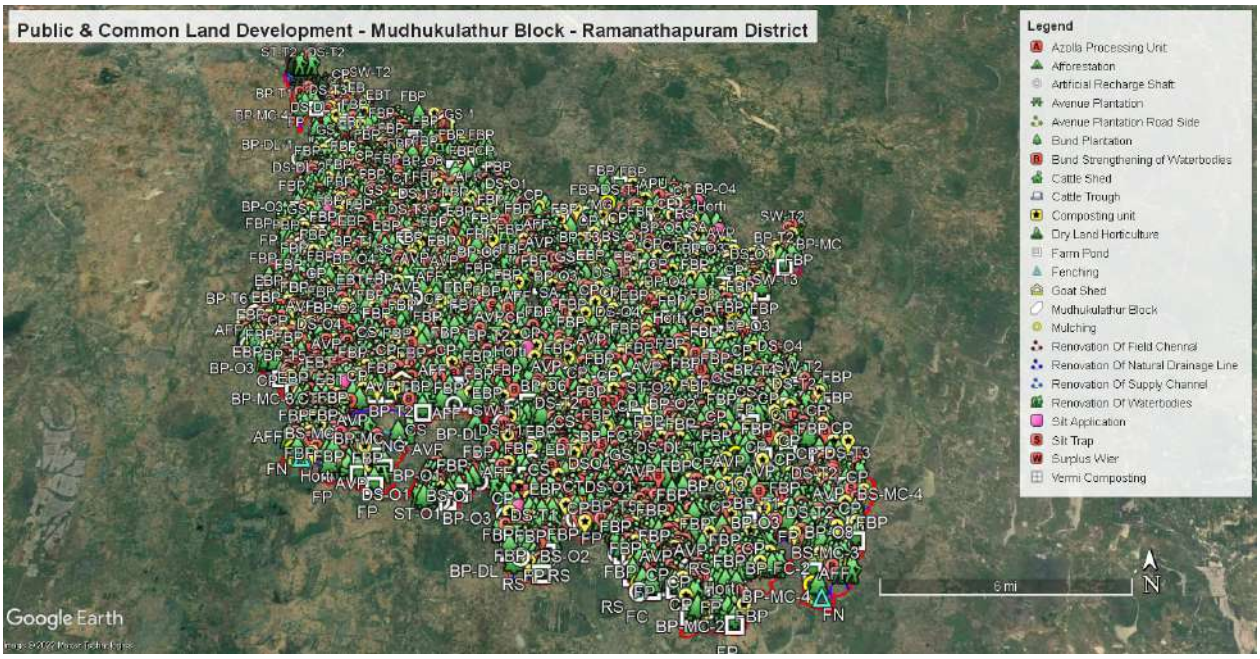


Figure 5.4. Proposed development activities in public and common land

5.2 DEVELOPMENT OF AGRICULTURE AND ALLIED SECTORS

Based on the assessment, the works which enhance agriculture and allied sectors particularly for irrigation, soil and livestocks are proposed in the lands under individual ownership (Table 12 & Figure 5.5).

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

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

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR (LAKHS)	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
FARM BUNDING WITH BOUNDARY TRENCHES - INDIVIDUAL (ha)	2,149	586	1.5	3,223.50	12,59,314
MICRO IRRIGATION (ha)	673	-	1	1,346	5,25,613
CONSTRUCTION OF FARM PONDS - INDIVIDUAL (NUMBER OF UNITS)	839	781	2	8,390	32,77,134
LAND DEVELOPMENT - INDIVIDUAL (ha)	1,076	3,906	10	9,146	35,73,396
DRY LAND HORTICULTURE/AGRO-FORESTRY - INDIVIDUAL (ha)	79	3,321	8.5	11.85	1,817
AZOLLA UNITS - INDIVIDUAL (NUMBER OF UNITS)	79	23	0.15	14.22	2,133
NADEP VERMI-COMPOST (NUMBER OF UNITS)	79	27	0.18	116.92	1,85,176
FODDER DEVELOPMENT - COMMUNITY & INDIVIDUAL	79	2,344	1.48	167.48	26,149
CATTLE SHELTERS (NUMBER OF UNITS)	3,012	331	2.12	6,837.24	10,69,260
GOAT SHEEP SHELTERS (NUMBER OF UNITS)	79	355	2.27	3.95	474
CATTLE TROUGH (NUMBER OF UNITS)	568	6	0.05	51.12	5,680
POULTRY SHED (NUMBER OF UNITS)	189	10	0.09	189	-

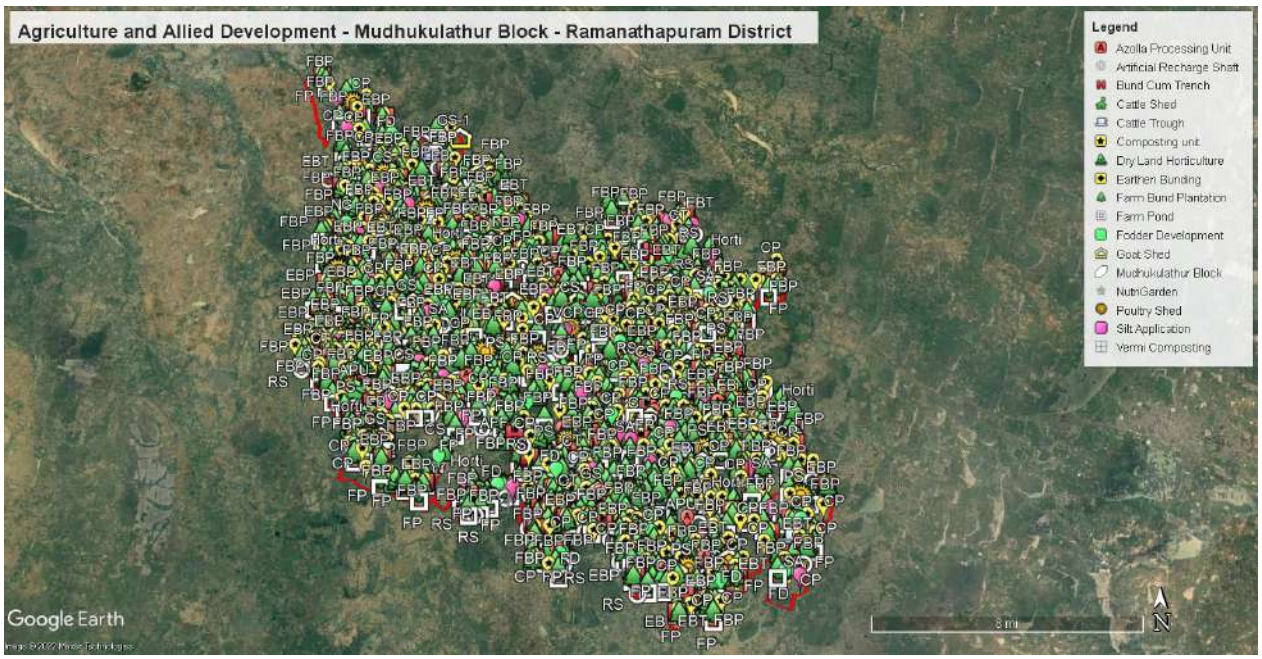


Figure 5.5. Proposed development activities in Agriculture and allied Sectors

5.3 DEVELOPMENT OF RURAL INFRASTRUCTURE

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

DEVELOPMENT OF RURAL INFRASTRUCTURE

TABLE 13. DETAILS OF WORK PROPOSED TO DEVELOP RURAL INFRASTRUCTURE

	NO. OF WORKS	PERSON DAYS PER UNIT	UNIT COST IN INR	ESTIMATED COST IN INR (LAKHS)	ESTIMATED PERSON DAYS
SOAK PITS (COMMUNITY) (NUMBER OF UNITS)	292	20	0.13	37.96	5,840
SOAK PITS (INDIVIDUAL) (NUMBER OF UNITS)	2910	16	0.1	291	46,560
ROOF RAIN WATER HARVESTING (NUMBER OF UNITS)	92	625	4	368	57,500
TANKA - COMMUNITY LEVEL (NUMBER OF UNITS)	-	300	30	-	-

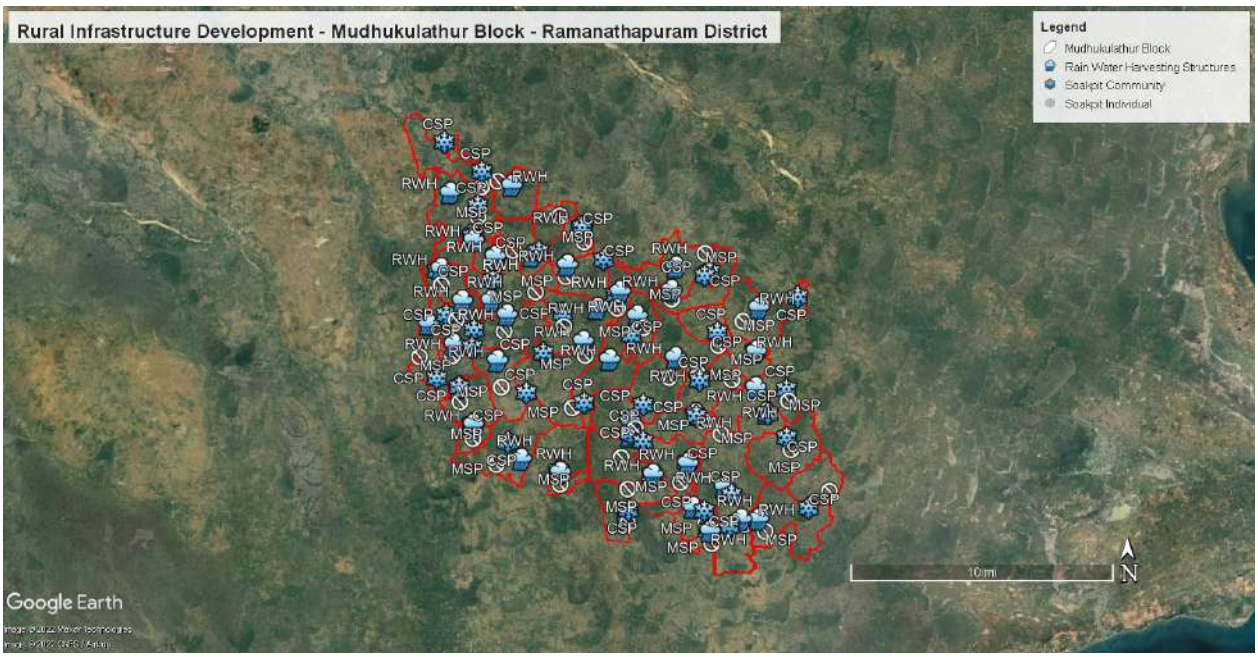


Figure 5.6. Proposed rural infrastructure activities

5.4 PROPOSED CLIMATE RESILIENCE MEASURES

Climate resilient measures are proposed to enable the system to cope up with future climate risks such as droughts, heatwaves and floods (Figure 5.7). Proposed CRM includes public, agriculture and rural infrastructure activities, whereas focus is given on public and common land development measures followed by agriculture and allied development (Table 14). Measures such as farm ponds (Table 15), horticulture park (Table 16), mega forest plantation (Table 17), avenue plantation (Table 18), mini forest (Table 19), tanka (Table 20), and GP level nursery development (Table 21), were proposed in this Block in saturation mode.

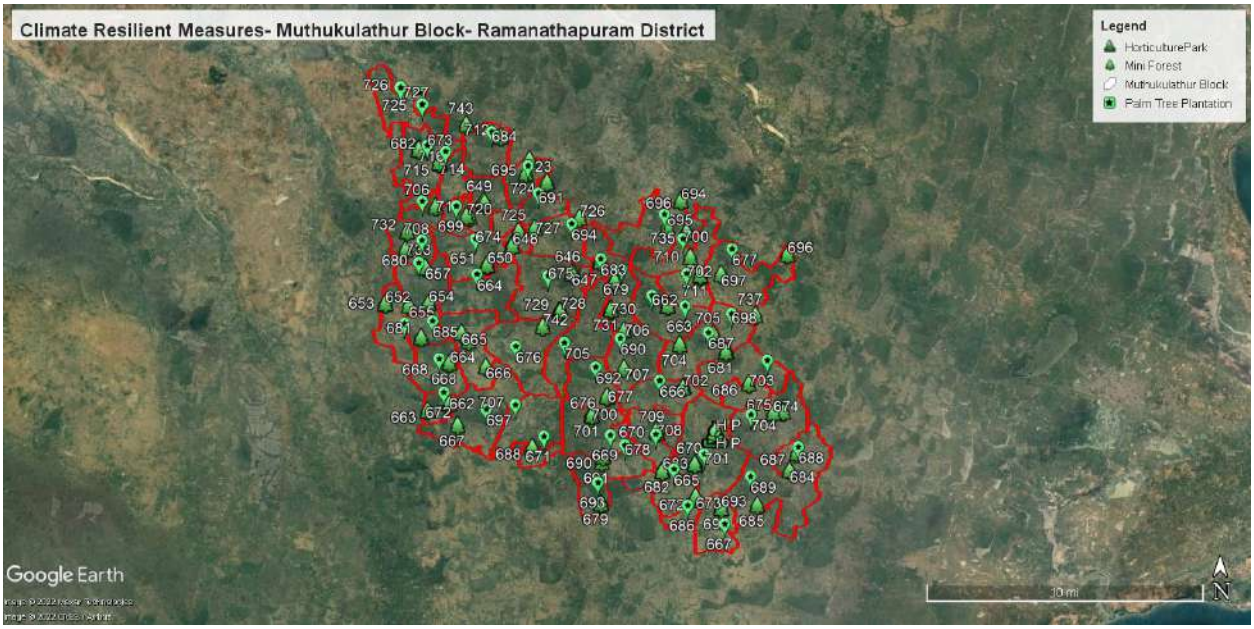


Figure 5.7. Proposed climate resilient measures

TABLE 14. GP WISE PROPOSED CRM

GP	Public or common land	Agriculture and allied	Rural infrastructure
Alangaanoor	Mini forest	GP level Nursery	Tanka
Anaiseri	Mini forest	GP level Nursery	Tanka
Arapothu	Mini forest	GP level Nursery	Tanka
Athanakuricchi	Mini forest	GP level Nursery	Tanka
Athankothangudi	Mini forest	GP level Nursery	Tanka
Athikulam	Mini forest	GP level Nursery	Tanka
Kakkoor	Mega forest Mini forest	GP level Nursery	Tanka
Karumal	Mini forest	GP level Nursery	Tanka
Kathakulam	Mini forest	GP level Nursery	Tanka
Keela Kanjirangulam	Mini forest	GP level Nursery	Tanka
Keelakodumalur	Mini forest	GP level Nursery	Tanka
Keelakulam	Mega forest Mini forest	GP level Nursery	
Keelathooval	Mega forest	GP level Nursery	Tanka
Keeranoor	Mini forest	GP level Nursery	Tanka
Kolundurai	Mega forest	GP level Nursery	Tanka
Kumarakuricchi	Mini forest Mega forest	GP level Nursery	Tanka
Mahindi	Mini forest	GP level Nursery	Tanka
Manallur	Mini forest	GP level Nursery	Tanka
Melakanicheri	Mega forest	GP level Nursery	Tanka
Melakodumalur	Mini forest	GP level Nursery	Tanka
Michealpattanam	Mini forest	GP level Nursery	Tanka
Nallukuricchi	Mini forest Avenue plantation	GP level Nursery	Tanka
Nallur	Mini forest	GP level Nursery	Tanka
Nullukuricchi	Mini forest		
Peiyailai	Mini forest	GP level Nursery	Tanka
Pirabakkalur		GP level Nursery	Tanka
Ponnakkaneri	Mini forest	GP level Nursery	Tanka
Pooseri	Mini forest	GP level Nursery	Tanka
Posukkudi	Mini forest	GP level Nursery	Tanka
Prabakkaloor	Mini forest		
Pulithikulam		GP level Nursery	Tanka
Puliyangudi	Mini forest	GP level Nursery	Tanka
Puluthikulam	Mini forest		
S R N Panagulam	Mini forest	GP level Nursery	Tanka
Sambakulam	Mini forest	GP level Nursery	Tanka
Sathanoor	Mini forest	GP level Nursery	Tanka
Sellur	Mini forest	GP level Nursery	Tanka
Selvanayagapuram	Mini forest	GP level Nursery	Tanka
Sempongudi	Mini forest	GP level Nursery	Tanka

Sirugudi	Mega forest	GP level Nursery	Tanka
Siruthalai	Mini forest	GP level Nursery	Tanka
Theriruveli	Mini forest	GP level Nursery	Tanka
	Horticulture park		
Thiruvarangam	Mini forest	GP level Nursery	Tanka
Ulaiyur	Mini forest	GP level Nursery	Tanka
Valanadu	Mini forest	GP level Nursery	Tanka
Vengalakuricchi	Mini forest	GP level Nursery	Tanka
	Mega forest		
Vikkiramapandiapuram	Mega forest	GP level Nursery	Tanka
	Mini forest		
Vilakkanendal	Mega forest	GP level Nursery	Tanka
Vilankulathur	Mini forest	GP level Nursery	Tanka

TABLE 15. DETAILS OF PROPOSED FARM PONDS ACTIVITY UNDER CRM

Block Target	Community Farm Ponds Completed	Individual Farm Ponds	Individual Farm Ponds Completed	Individual Farm Ponds Ongoing
161	81	80	73	7

TABLE 16. DETAILS OF PROPOSED HORTICULTURE PARK ACTIVITIES UNDER CRM

GP	Area for Plantation (In ha)	Total No. of Plants (1 ha - 10000 saplings)	Classification of land
Therurveli	2.50	60	**Govt./ Purampokku land**

TABLE 17. DETAILS OF PROPOSED MEGA FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (In ha)	Total No. of Plants (1ha - 10000 saplings)	Classification of land
Kakkur	0.5 ha in each GP	5,000 saplings in each GP	**Govt Purampok-ku land**
Keelakulam			
Keelathooval			
Kolunthurai			
Kumarakurichi			
Melakanniseri			
Sirukudi			
Vengalakurichi			
Vikkiramapandiyapu-ram			
Vilakkanendal			
Total	**5**	**50,000**	

TABLE 18. DETAILS OF PROPOSED AVENUE PLANTATION ACTIVITY UNDER CRM

GP	Road Length (in km)	Total No. of Plants (1ha - 10000 saplings)		Total No.of Plants	Classification of Land
		Number of Big Trees	Number of Small Trees		
Nallukurichi	4.46	446	1,496	1,938	Govt Puram-pokku land

TABLE 19. DETAILS OF PROPOSED MINI FOREST ACTIVITY UNDER CRM

GP	Area for Plantation (In ha)	Total No. of Plants (1 ha - 10000 saplings)	Classification of land
Alanganur	0.10	1,000	Govt Purampokku land
Anaiseri	0.15	1,500	
Arapothu	0.10	1,000	
Athanakuricchi	0.15	1,500	
Athankotthankudi	0.10	1,000	
Attikulam	0.10	1,000	
Kakkur	0.10	1,000	
Karumal	0.10	1,000	
Katthakulam	0.15	1,500	
Keelakanjirankulam	0.10	1,000	
Keelakodumalur	0.15	1,500	
Keelakulam	0.15	1,500	
Keelathooval	0.15	1,500	
Keeranur	0.10	1,000	
Kolunthurai	0.15	1,500	
Kumarakuricchi	0.20	2,000	
Makindi	0.10	1,000	
Manallur	0.10	1,000	
Melakanniseri	0.10	1,000	
Melakodumalur	0.10	1,000	
Mikkelpattinam	0.10	1,000	
Nallukuricchi	0.05	500	
Nallur	0.10	1,000	
Nullukuricchi	0.10	1,000	
Periyaelai	0.10	1,000	
Ponnakkaneri	0.10	1,000	
Pooseri	0.10	1,000	
Posukkudi	0.10	1,000	
Prabakkaloor	0.10	1,000	
Puliyangudi	0.10	1,000	
Puluthikulam	0.10	1,000	
S.R.N.Palangulam	0.10	1,000	
Sambakulam	0.10	1,000	
Satthanur	0.10	1,000	
Sellur	0.10	1,000	

Selvanayagapuram	0.10	1,000	Govt Purampokku land
Sempongudi	0.10	1,000	
Sirukudi	0.10	1,000	
Siruthalai	0.10	1,000	
Theriruveli	0.10	1,000	
Thiruvarangam	0.15	1,500	
Ulaiyur	0.10	1,000	
Valanadu	0.10	1,000	
Vengalakuricchi	0.10	1,000	
Vikkirapandiyapuram	0.10	1,000	
Vilakkanendal	0.10	1,000	
Vilankulathur	0.20	2,000	
Total	**5.25**	**52,500**	

TABLE 20. DETAILS OF PROPOSED TANKAS ACTIVITY UNDER CRM

Sl. No.	GP	Classification of land
1	Alanganoor	Government Land
2	Anaiseri	
3	Arapothu	
4	Athanakurichi	
5	Athankothangudi	
6	Athikulam	
7	Kakkoor	
8	Karumal	
9	Kathankulam	
10	Keela Kanjirangulam	
11	Keelakodumalur	
12	Keelakulam	
13	Keelathooval	
14	Keeranoor	
15	Kolundurai	
16	Kumarakurichi	
17	Mahindi	
18	Manaloor	
19	Melakanicheri	
20	Melakodumalur	
21	Michealpattanam	
22	Nallukuricih	
23	Nallur	
24	Peiyailai	
25	Pirabakkalur	
26	Ponnakkaneri	
27	Pooseri	
28	Posukkudi	
29	Pulithikulam	

30	Puliyangudi	Government Land
31	S R N Panagulam	
32	Sambakulam	
33	Sathanoor	
34	Sellur	
35	Selvanayagapuram	
36	Semponkudi	
37	Sirukudi	
38	Siruthalai	
39	Theriruveli	
40	Thiruvarangam	
41	Ulaiyur	
42	Valanadu	
43	Vengalakurichi	
44	Vikkiramapandiapu-ram	
45	Vilakkanenthal	
46	Vilangulathur	

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

Sl. No.	Name of the Block	GP
1	Alangaanoor	1,000 in each GP
2	Anaiseri	
3	Arapothu	
4	Athanakurichi	
5	Athankothankudi	
6	Athikulam	
7	Kakkur	
8	Karumal	
9	Kathakulam	
10	Keelakanchirankulam	
11	Keelakodumalur	
12	Keelakulam	
13	Keelathooval	
14	Keeranur	
15	Kolunthurai	
16	Kumarakurichi	
17	Makindi	
18	Manaloor	
19	Melakkanniseri	
20	Melakodumalur	
21	Michealpattanam	
22	Nallukurichi	
23	Nallur	
24	Periya Ilai	

25	Pirabukkalur	1,000 in each GP
26	Ponnakkaneri	
27	Pooseri	
28	Posukkudi	
29	Pulithikulam	
30	Puliyangudi	
31	S.R.N.Palankulam	
32	Sambakulam	
33	Sathanur	
34	Sellur	
35	Selvanayagapuram	
36	Semponkudi	
37	Sirugudi	
38	Siruthalai	
39	Theriruveli	
40	Thiruvarangam	
41	Ulaiyur	
42	Valanadu	
43	Vengalakurichi	
44	Vikkiramapandiapuram	
45	Vilakkanenthal	
46	Vilankulathur	
	Total	**46,000**

நெடுங்கடலும் தன்நீர்மை குன்றும் தடிந்தெழிலி
தான்நல்கா தாகி விடின்

குறள் - 17

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

Thirukkural - 17

CHAPTER 6

PROJECTED OUTCOMES OF PLANNING

6 PROJECTED OUTCOMES OF PLANNING

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

6.1 OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

OUTCOMES OF DEVELOPMENT OF PUBLIC AND COMMON LANDS

	INDICATOR	OUTCOMES/ IMPACT
1	Proportion of Land development under WASCA treatment	4,318.15 ha (11.73 %) of the total area treated under WASCA
2	Percentage reduction of run off	1,451.22 ha.m i.e. 22.71 % of the total runoff harvested due to WASCA interventions
3	No. of waterbodies restored	1,361 waterbodies (tanks and ooranis) restored
4	Area under afforestation	368 ha area under afforestation
5	Length of drainage line treated	29.2 km length of drainage line treated
6	Canal Bund Plantation	More than 49 thousand plants through 262 works
7	Nursery development	728 units

4,318.15 ha
AREA TREATED

1,451.22 ha.m
TOTAL RUNOFF HARVESTED

1,361
WATER BODIES RESTORED

368 ha
AREA AFFORESTATION

29.2 km
DRAINAGE LINE TREATED

49,000
PLANTS

728 UNITS
NURSERY DEVELOPMENT

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	839 farm ponds established which target the harvest of 14,76,640 cu.m of water which has the potential to irrigate 293.65 ha area
2	Improvement in soil health	79 NADEP vermicomposting units for soil health improvement
3	Dry land development with agro-forestry	788 ha under dry land horticulture
4	Households established fodder plots	3,355 vulnerable households established fodder plots
5	Sheds for livestock's (cattle, goat, poultry)	3,280

839 FARM PONDS

79 COMPOST UNITS

3,355 FODDER PLOTS

788 ha DRY LAND HORTICULTURE

3,280 SHEDS FOR LIVESTOCK'S

6.3 OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

OUTCOMES OF RURAL INFRASTRUCTURE DEVELOPMENT

	INDICATOR		OUTCOMES/ IMPACT
1	No. of GPs having liquid waste management systems	1	2,910 individual and 292 community level soak pits established for recycle of grey water benefiting 31,620 HHs
2	Roof rain water harvesting measures	2	92 common roof rainwater harvesting and storage structures with a target to harvest and store 0.115 ha.m of rainwater for use
3	Nutri-garden	3	31,620 HHs established nutri-gardens in homesteads and planted 1,58,100 saplings

292 COMMON & **2,910** INDIVIDUAL SOAK PITS

92 COMMON ROOF RAINWATER HARVESTING

31,620 NUTRI-GARDENS

1,58,100 SAPLINGS

6.4 OUTCOMES OF CLIMATE RESILIENCE MEASURES

OUTCOMES OF CLIMATE RESILIENCE MEASURES

	INDICATOR	OUTCOMES/ IMPACT
1	Climate resilient measures are identified for climate risks	7 models are identified via., farm ponds, horticulture park, avenue plantation, mini forest, mega forest, tankas, and GP level nursery development 161 farm ponds Horticulture Park in 2.50 ha. Mega forest in 5 ha area with 50,000 plants Avenue plantation along the road of length 4.46 km with 1,938 plants Mini forest in 5.25 ha with 52,500 plants Tankas in 46 GPs 46 GP Nursery development sites with 46,000 plants

161
FARM PONDS

2.50 ha
HORTICULTURE PARK

46
GP LEVEL NURSERY

5 ha
MEGA FOREST

46
TANKAS

5.25 ha
MINI FOREST

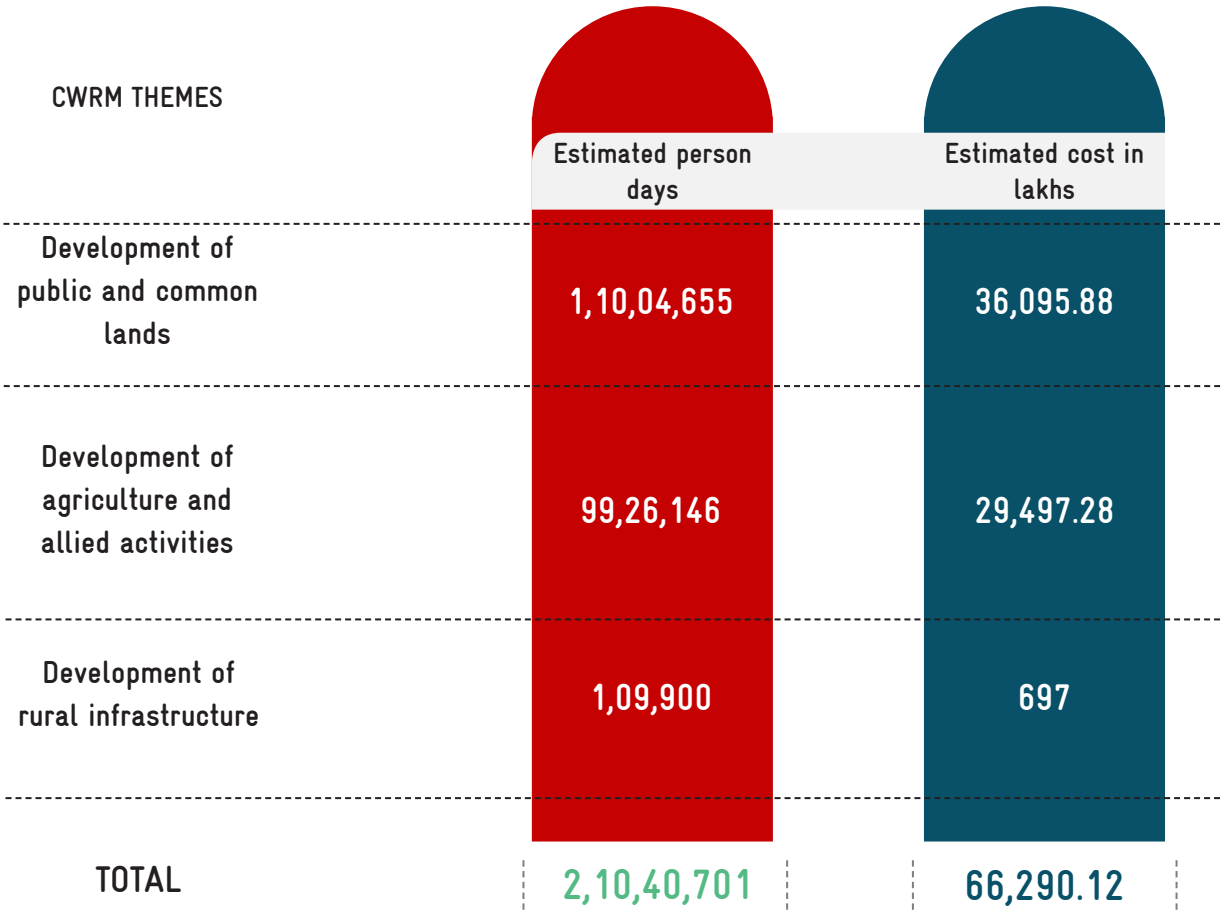
4.46 km
AVENUE PLANTATION

Estimated person days

The total estimated person days required for the above propose activities are 2,10,40,701 as specified below Figure 6.1.

Estimated Cost

The total estimated cost budgeted for the above propose activities is Rs. 66,290.12 Lakhs as specified below in Figure 6.2.



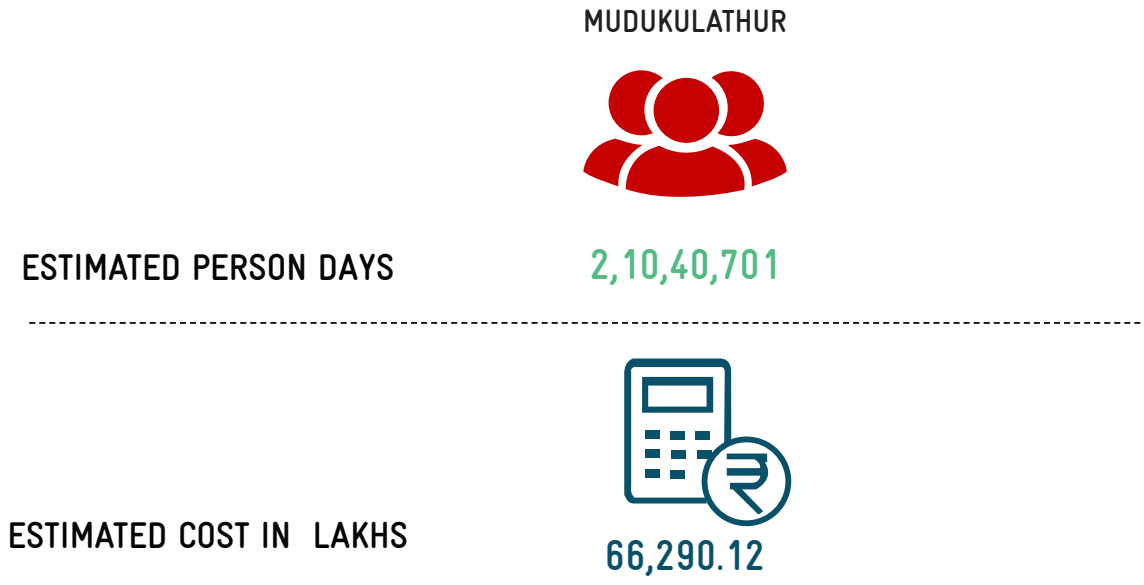


Figure 6.1 & 6.2. Estimated person days & cost for all water actions

6.5 LINKAGES TO SDGS, NDCS

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

6.5.1 NATIONALLY DETERMINED CONTRIBUTION GOALS AND WASCA TN PROGRESS THROUGH NDC

2015 was a historic year in which 196 Parties came together under the Paris Agreement to transform their development trajectories so that they set the world on a course towards sustainable development, aiming at limiting warming to 1.5 to 2 ◦ C above pre-industrial levels. Through the Paris Agreement, Parties also agreed to a long-term goal for adaptation – to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production. Additionally, they agreed to work towards making finance flows consistent with a pathway towards low greenhouse gas emissions and climate- resilient development. Nationally Determined Contributions (NDCs) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, Paragraph 2) requires each Party to prepare, communicate and maintain successive NDCs that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

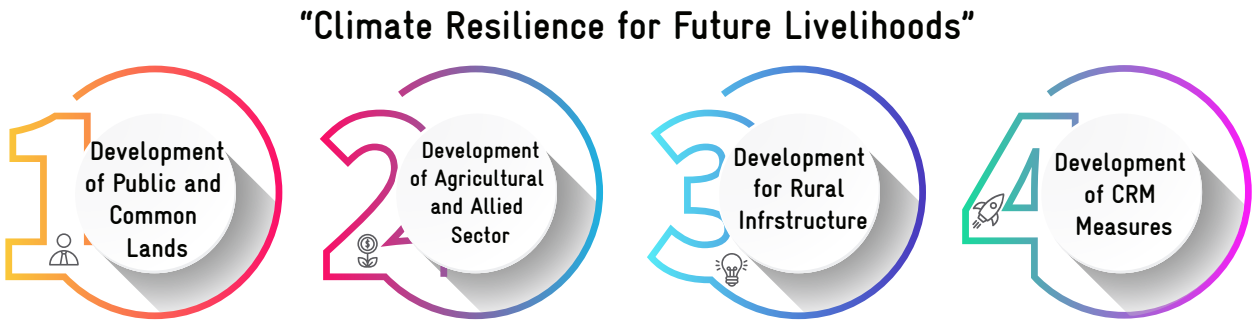
Internationally, the recent process on NDC Enhancement (2020) significantly acknowledge the climate change vulnerability on national sectors including agriculture, energy, and urban areas, especially through impacts on water resources. The role that water and water-related activities play in national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

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

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

6.5.2 WASCA TN SUPPORTS SDG

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



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

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

SDG GOAL 6

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

6.1	Achieve universal and equitable access to safe and affordable drinking water for all
6.2	Achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3	Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4	Increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
6.5	Implement integrated water resources management at all levels (6.5.1)
6.6	Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
6.A	Expand international cooperation and capacity-building support to developing countries in water-and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.B	Support and strengthen the participation of local communities in improving water and sanitation management

Indicators considered for district and Block level vulnerability assessment of WASCA TN which is also used in SDG India 2020-21 report (Table 22)

TABLE 22. COMMON VULNERABILITY INDICATORS USED IN WASCA TN & SDG INDIA 2020-21

Head count ratio as per the multidimensional poverty index (%)	
	Persons provided employment as a percentage of persons who demanded employment under MGNREGA

Percentage of rural population getting safe and adequate drinking water within premises through piped water supply

Percentage of rural population having improved source of drinking water

Percentage of ground water withdrawal against availability

Percentage of Blocks/Mandals/Talukas over-exploited

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

Percentage of degraded land over total land area

Percentage increase in area of desertification

The indicators used for district level vulnerability assessment along with its linked SDGs are already tabulated in (Table 2). The detailed proposed water actions in CWRM which was assessed based on the vulnerability dimensions are linked with climate vulnerability index and SGDs are tabulated in Table 23 to 25

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

Name of the work	No. of CWRM works	Climate Vulnerability Index Impacting (WASCA TN)	Linked SDG Goal
Contour Continuous Bunds for Afforestation area (m)	1,471	W3	SDG 1,2, 6,13&15
Composting (No. of units)	673	W1	SDG1& 6
Afforestation in Public/common lands (ha)	368	C1,C2,C3, W3,	SDG 1, 2,6,13&15
Block Plantation (Community) (ha)	1,525	C1,C2,C3,W3,S2	SDG 1,2, 6 &13, 15
Silvi-pasture Development (ha)	14	C1,C2,C3,W3	SGG 12 &15
Linear Plantation (km)	67	C1,C2,C3,W3,S2	SDG 1,2,6,12&13, 15
Canal Bund Plantation (ha)	246	C1,C2,C3,W3,S2	SDG 1, 6&13, 15
Irrigation Channel Plantation (m)	20,408	W4,W5,S2	SDG 1,2& 6, 15
Avenue plantation (km)	200	C1,C2,C3,W3,S2	SDG 1, 6&13

Nursery Development (No. of units)	728	C1,S2,S4	SDG 1,2 &6
Restoration of waterbodies :PWD and Union Tanks (No.)	157	S2, S1	SDG 6, 1, 13
Restoration of water bodies : Ooranis (No.)	288	S2, S1	SDG 6, 1, 13
Restoration of waterbodies :Ponds (No.)	-	S2, S1	SDG 6,1, 13
Artificial Recharge Structure (No. of units)	211	W3	SDG 1, 2, & 6
Water Course - Irrigation Channels - Desilting (m)	20,408	C1,C2,C3,W3,S2	SDG 1, 6&13
Drainage Line Treatment (m)	730	W1,W3,W4	SDG1 & 6

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

Name of the Work	No. of CWRM works	CVI	SDG
Farm Bunding with Boundary Trenches - Individual (ha)	2,149	A1,A3,W1,W3	SDG 1,2&6
Micro Irrigation(ha)	673	A1,A3,A5,W5	SDG 1, 2&6
Construction of Farm Ponds - Individual (No. of units)	839	A1,A3,W5,W1, W3	SDG 2& 6
Land development - Individual (ha)	1,076	W1,W5,A1,A3,S2,S4	SDG 2, 6&
Dry land Horticulture/Agro-forestry - Individual (ha)	79	A1,A3,A4,W1,S4,S2,C1	SDG 1& 2,15
Azolla units - Individual (No. of units)	79	A3,A4,S4	SDG 1& 2
NADEP Vermi compost (No. of units)	79	A3, W1, S4	SDG 1& 2,6
Fodder development - Community & Individual	79	A3, S4	SDG 1& 2, 15
Cattle shelters (No. of units)	3,012	S4	SDG 1& 2
Goat/sheep shelters (No. of units)	79	S4	SDG 1& 2
Cattle trough(No. of units)	568	W5,S4	SDG 1& 2
Poultry Shed (No. of units)	189	S2,S4	SDG 1& 2

TABLE 25. WATER ACTIONS ON RURAL WATER MANAGEMENT & IT'S LINKED SDG

Name of the work	No. of CWRM works	CVI	Linking SDG
Soak Pits (Community) (No. of units)	292	W3,S2	SDG 1& 6
Soak Pits (Individual) (No. of units)	2910	W3,S2	SDG 1& 6
Roof Rain Water harvesting (No. of units)	92	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

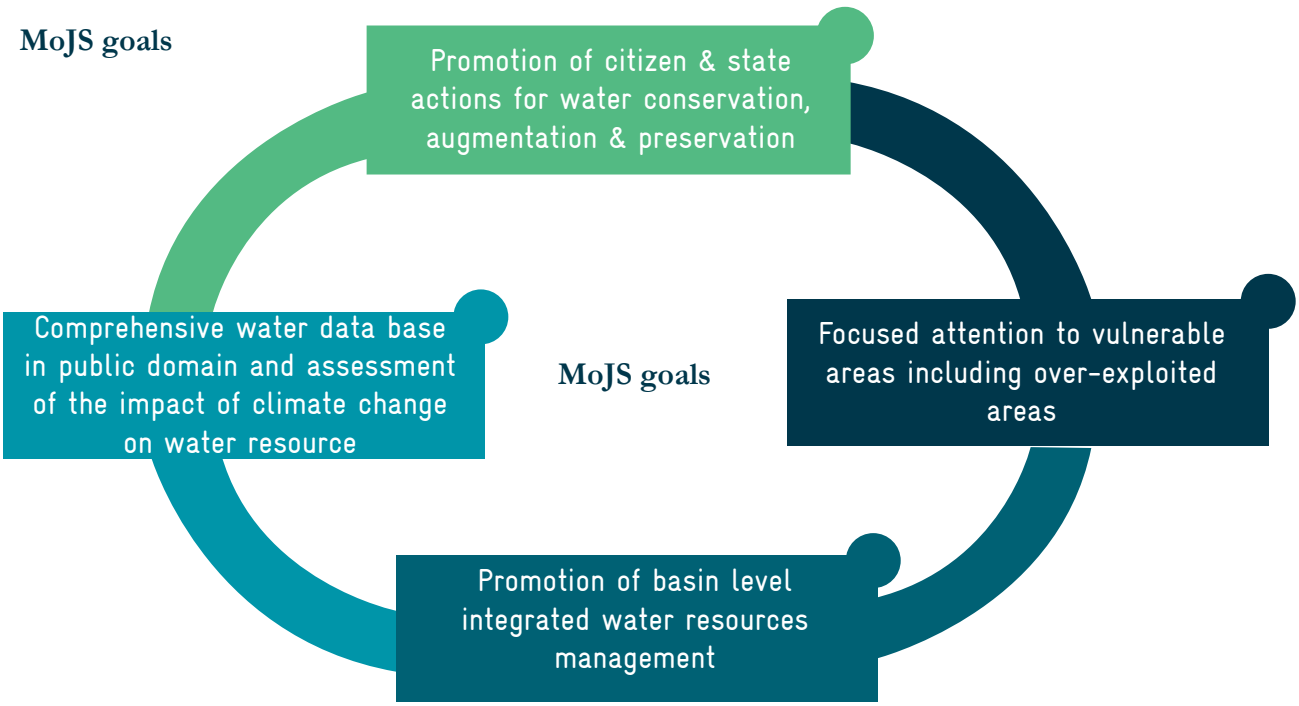
7 IMPLEMENTATION OF GP PLANS

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 Mudukulathur Block is listed in Table 26 and work progress, expenditure during the past 3 financial years are shown in Figure 7.1 and 7.2. The Total No. of works, ongoing and completed GIS works are shown in Figure 7.3. The GP wise recommendations and works uploaded are given in Annexure 7.1.

TABLE 26. GIS-BASED PLAN IMPLEMENTATION- KEY PARAMETERS PERFORMANCE IN MUDUKULATHUR BLOCK



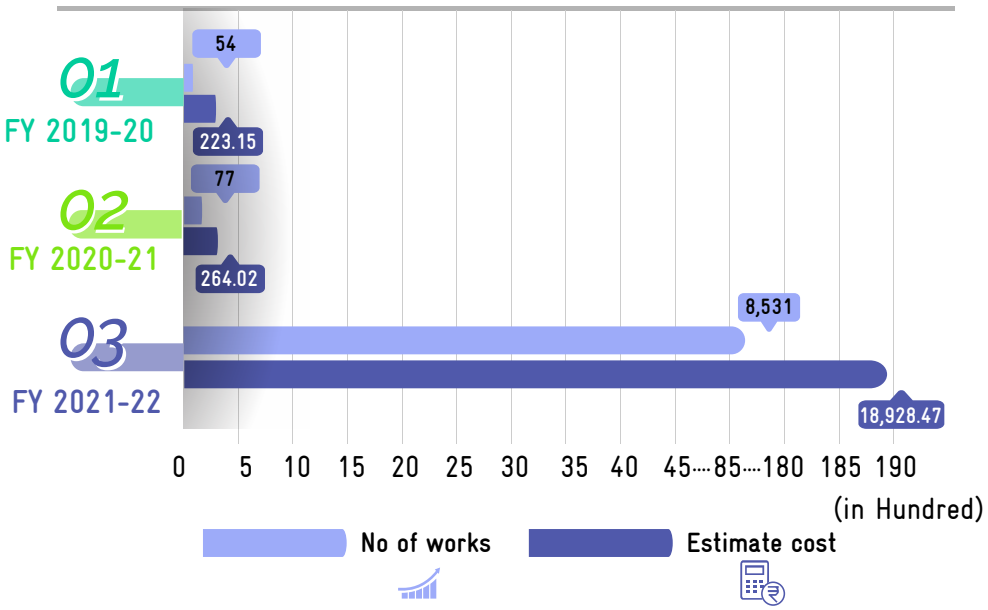


Figure 7.1. Work progress in last 3 years

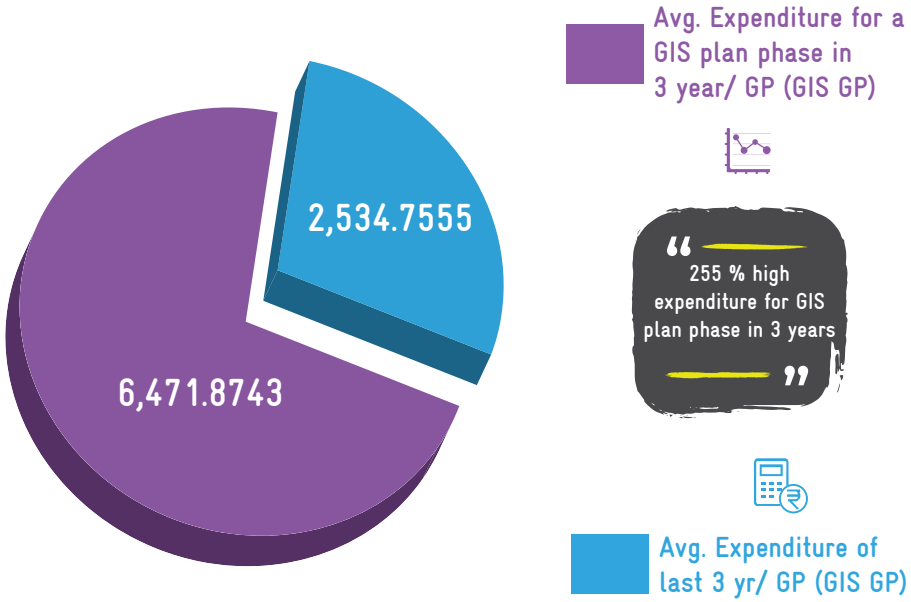
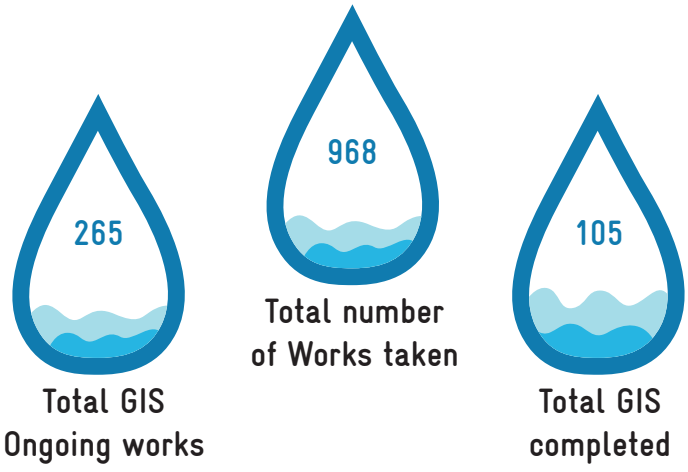


Figure 7.2. Average Expenditure for GIS plan in last 3 years



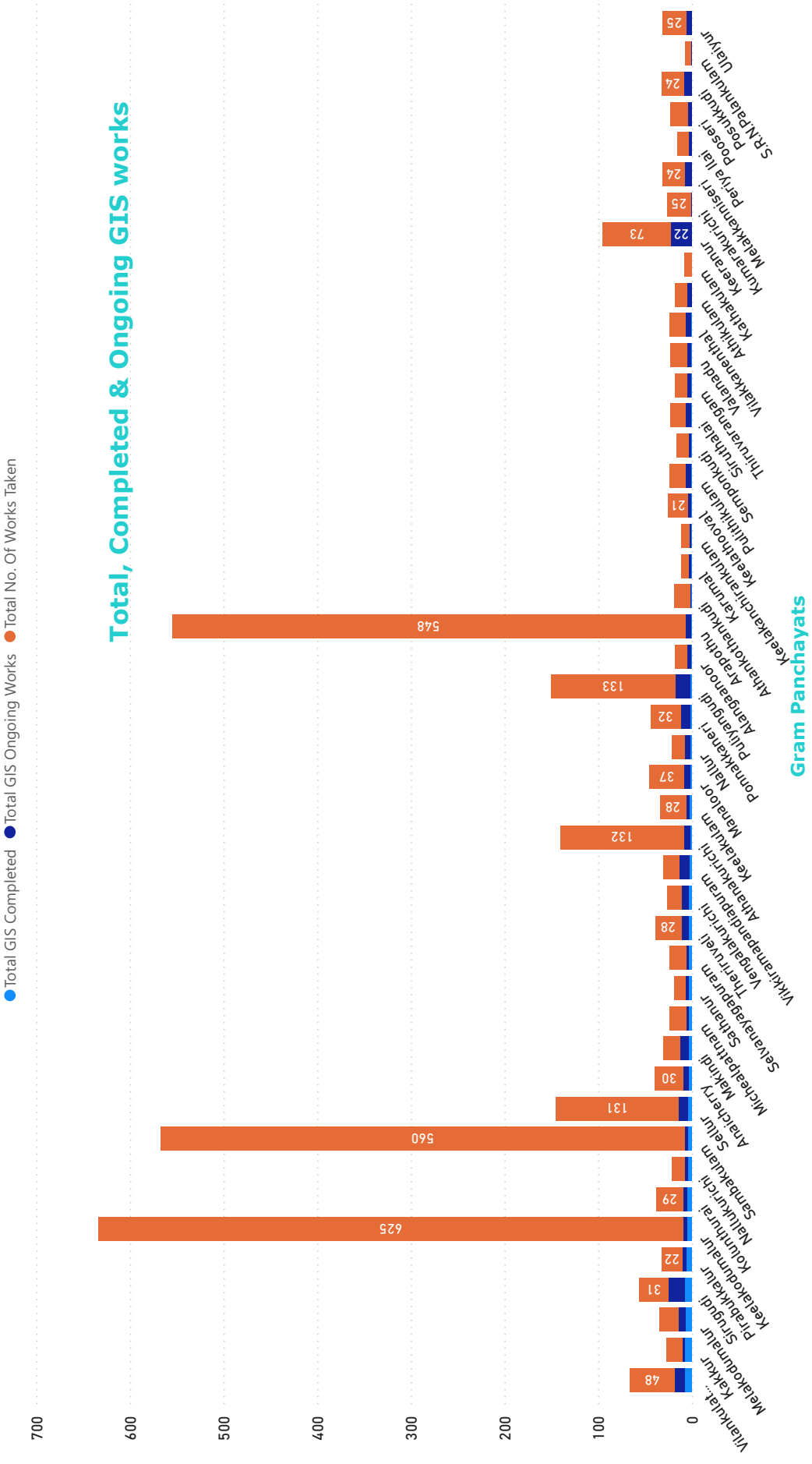
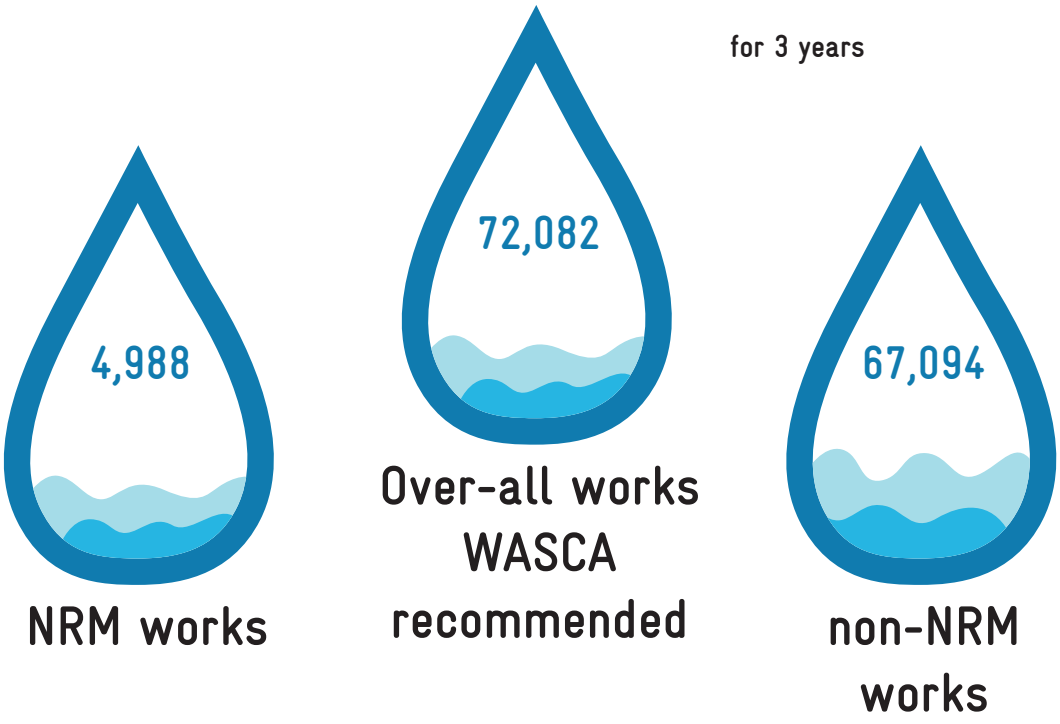


Figure 7.3. GP wise total, completed and ongoing GIS works (2021-22)

7.2 WASCA RECOMMENDED NRM AND NON-NRM WORKS

WASCA recommended 72,082 works for a period of 3 years, out of which 4,988 are NRM works and 67,094 are non NRM works (Figure 7.4). A total of 8,005 works has been uploaded so far for the financial year 2021-22 as on 16/03/2022.



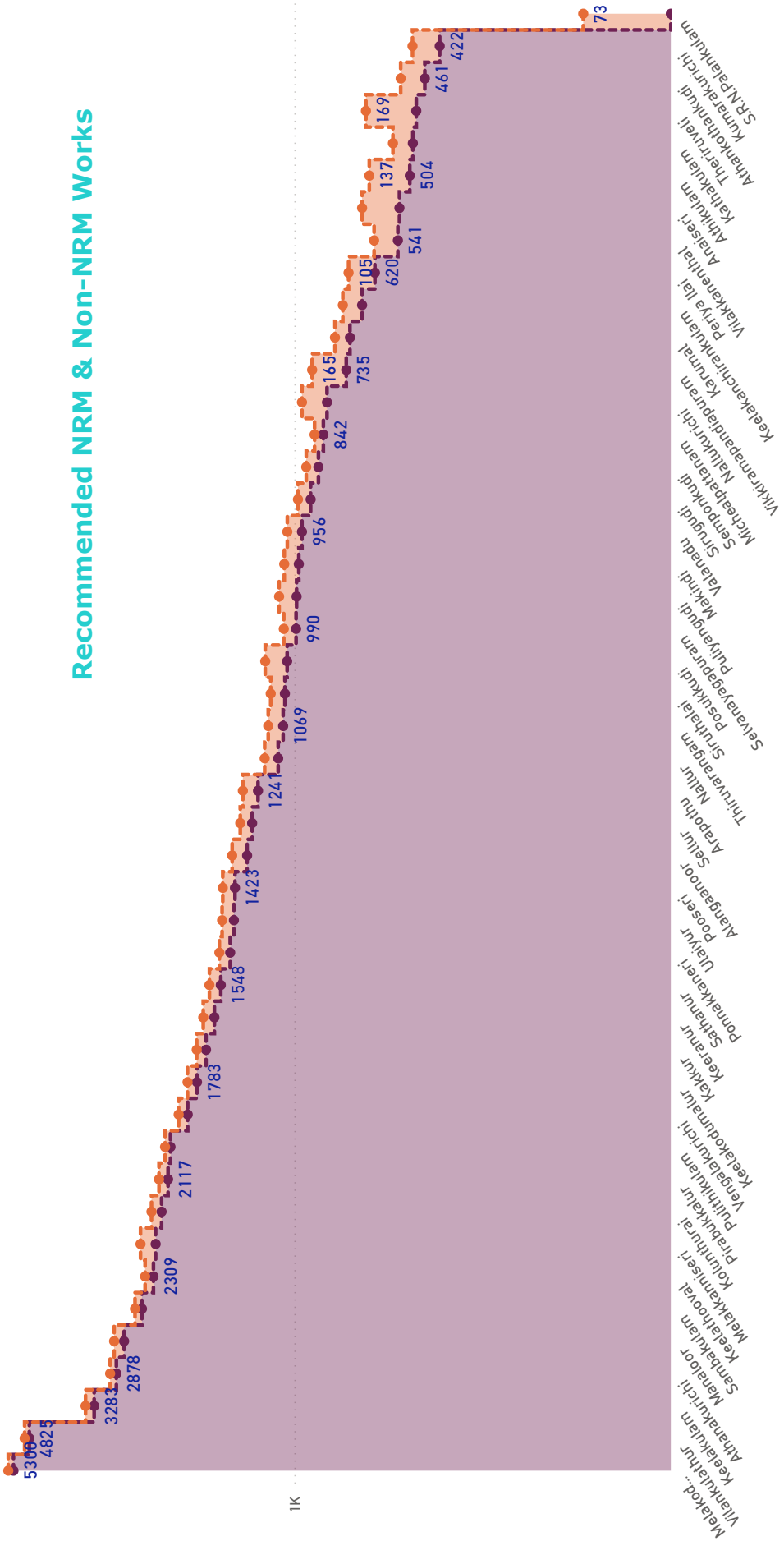


Figure 7.4. GP wise recommended NRM and Non-NRM works

7.3 ONGOING WORKS

The ongoing works in Mudukulathur Block includes Water Conservation and Water Harvesting, Works on Individuals Land (Category IV), Rural Connectivity, and Drought Proofing. A total of 148 works are ongoing in the Block, in which WCWH related work are more (52.7 %) followed by individual beneficiaries works (22.30 %) while rural infrastructure works are less in numbers (Figure 7.5), GP and work category wise ongoing works are tabulated in Annexure 7.2.

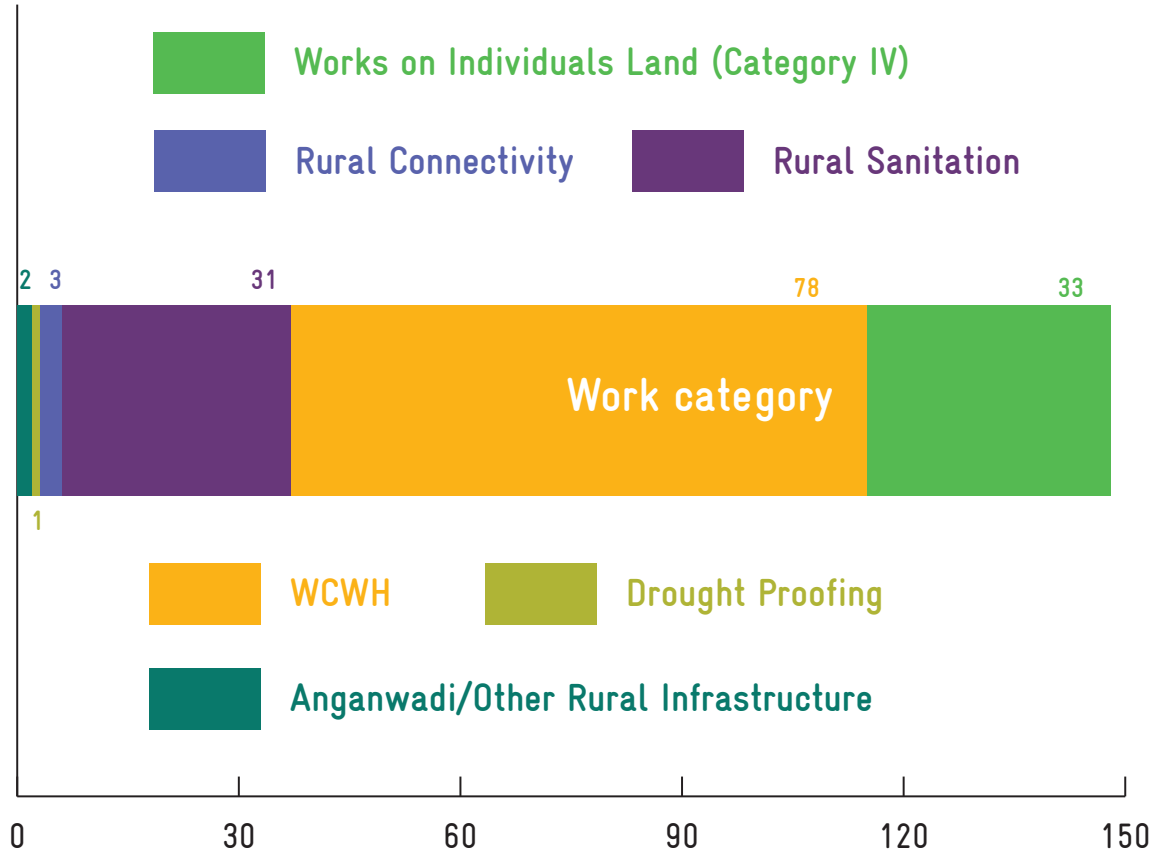


Figure 7.5. Category-wise ongoing works in Mudukulathur Block

7.4 CATCH THE RAIN

The NWM's campaign "Catch The Rain" with the tagline "Catch the rain, where it falls, when it falls" is to nudge the states and stakeholders to create appropriate Rain Water Harvesting Structures (RWHS) suitable to the climatic conditions and subsoil strata before monsoon season. Under this campaign, drives to make check dams, water harvesting pits, rooftop RWHS, removal of encroachments and de-silting of tanks to increase their storage capacity, removal of obstructions in the channels which bring water to them from the catchment areas, repairs to step-wells and using defunct bore wells and unused wells to put water back to aquifers etc., are to be taken up with the active participation of people. The total expenditure towards progressive works on Catch the Rain campaign of Mudukulathur Block is Rs. 2,673.31 Lakhs and nearly 82.12 % of the expenditure utilized for water conservation and Rain water harvesting (Figure 7.6).

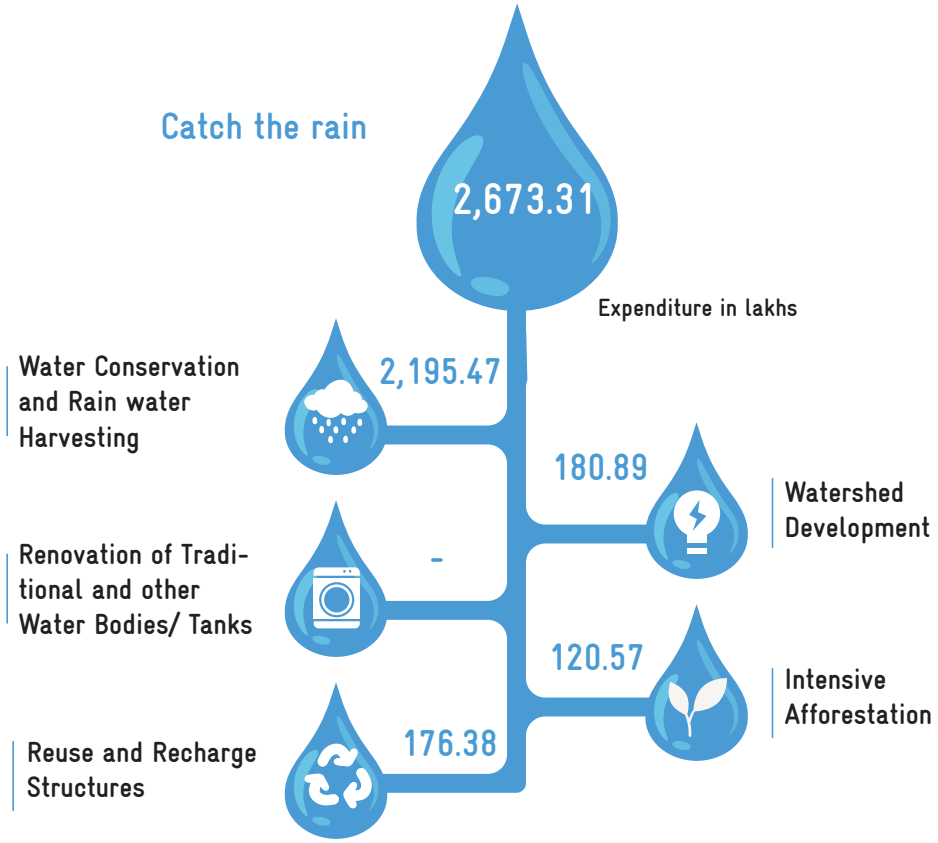
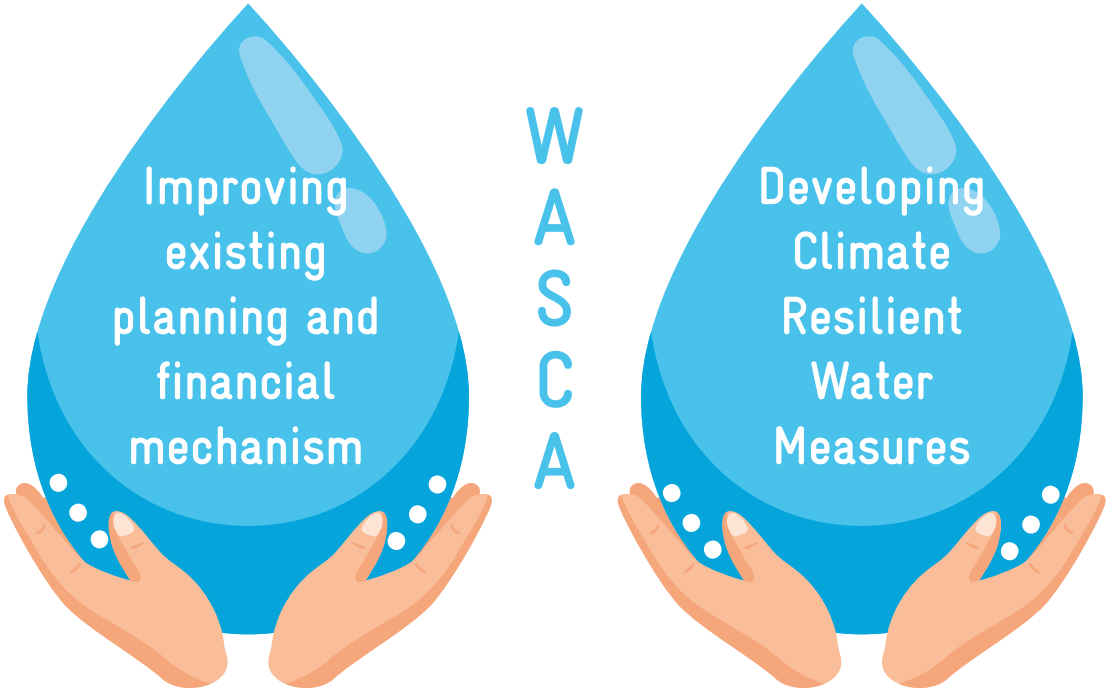


Figure 7.6. Expenditure for Catch the Rain campaign in Mudukulathur Block



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 MUDUKULATHUR BLOCK

Mudukulathur Block comes under Palar, Lower Gundar, Paralayar and Uthirakosamangaiyar sub-basins of Gundar basin. Uthirakosamangaiyar and Paralayar Rivers flow through the Block. Gridhambal, Lower Vaigai (3), Lower Vaigai (4) and Terkku Upper macro- watersheds cover the Block and has 94 micro-watersheds. Gridhambal watershed (4A1D3) has 30 micro-watersheds covering an area of 1,0371.49 ha. Lower Vaigai (3) watershed (4A2A2) has 4 micro-watersheds covering an area of 960.55 ha. Lower Vaigai (4) watershed (4A2A1) consists of 11 micro-watersheds covering an area of 2906.79 ha. Therkku Upper watershed (4A1D6) has 49 micro-watersheds covering an area of 25,293.39 ha. (Table 27). Out of 46 GPs in Mudukulathur Block, 14 GPs fall under Gridhambal macro-watershed, 2 GPs fall under Lower Vaigai (3) watershed, 4 GPs under Lower Vaigai (4) watershed (4A2A1) and 26 GPs under Therkku Upper watershed (4A1D6). (Table 28). The map below shows the boundary of Gridhambal, Lower Vaigai (3), Lower Vaigai (4) and Therkku Upper Watersheds boundaries on Mudukulathur Block boundary. 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 27. GENERAL DESCRIPTION OF MACRO-WATERSHEDS COVERING MUDUKULATHUR BLOCK

Macro-watershed	Area in ha	No. of micro-watersheds
Gridhambal	10371.49	30
Lower Vaigai (3)	960.55	4
Lower Vaigai (4)	2906.79	11
Therkku Upper	25293.39	49

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

Name of watershed	No. of GPs
Gridhambal	14
Lower Vaigai (3)	2
Lower Vaigai (4)	4
Therkku Upper	26

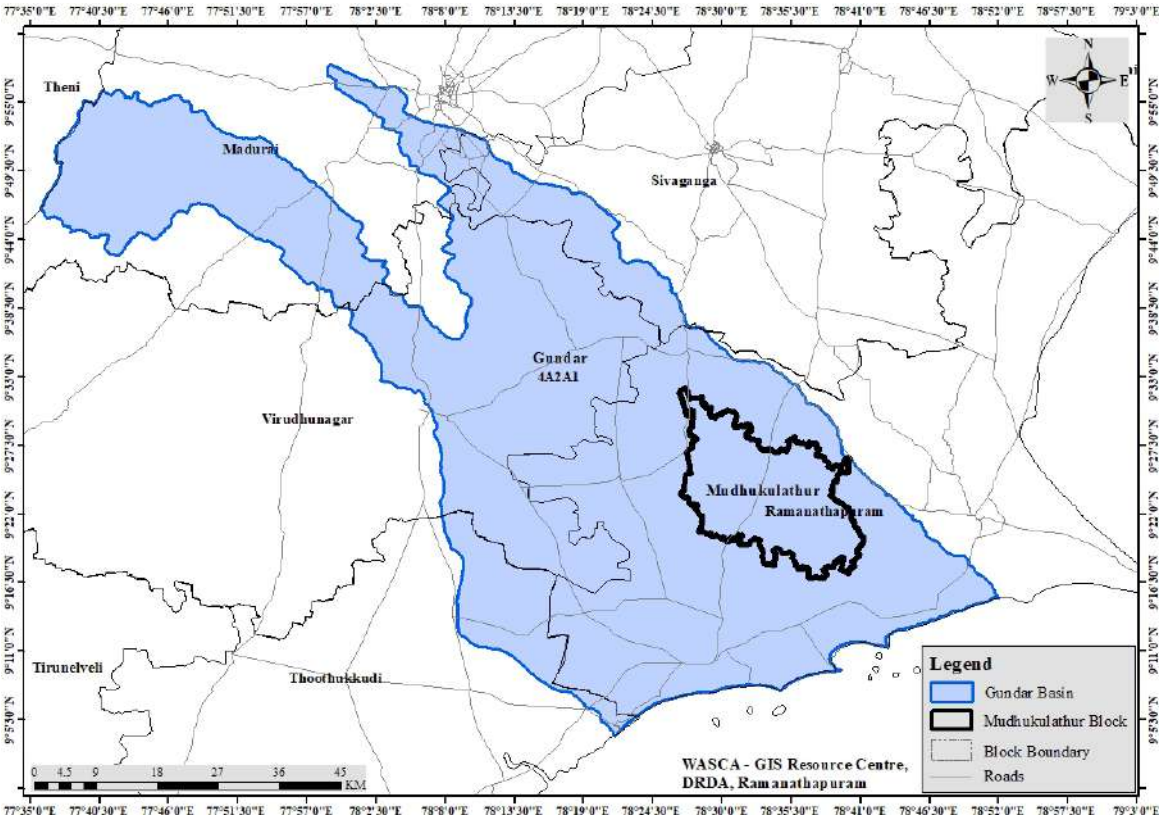


Figure 8.1. Macro-watershed map - Mudukulathur Block

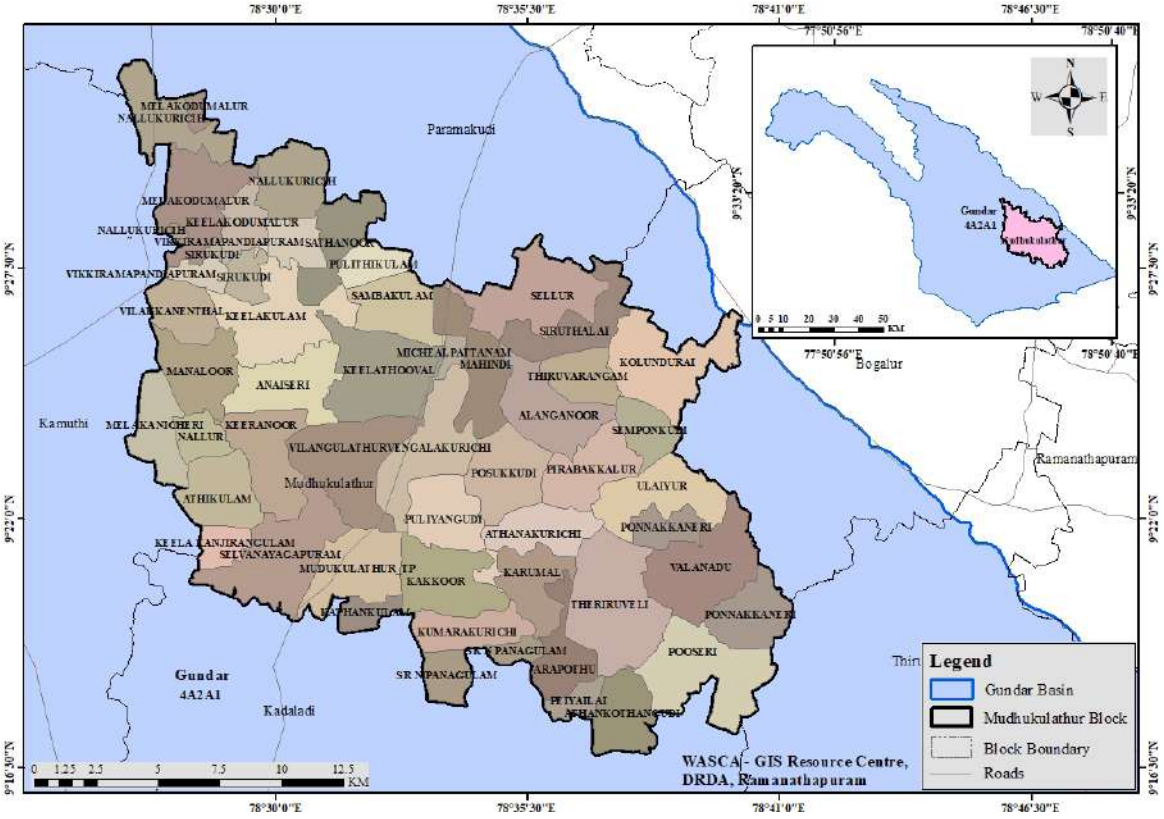


Figure 8.2. Macro-watershed with GPs

All the proposed works are identified using basin, sub-basin, and micro-watershed with GP administrative boundaries through Composite Water Resources Management plan approach. The ridge details, proposed works in all macro-watersheds of GPs in Mudukulathur Block are listed in Tables 29 to 40.

TABLE 29. MICRO-WATERSHED FALLING UNDER GRIDHAMBAL MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A1D3c05a	30.10550419	Lower
2	4A1D3c08c	60.86053839	
3	4A1D3c04b	211.36394	
4	4A1D3c08b	296.4447869	
5	4A1D3c04a	291.4428882	
6	4A1D3c04c	594.6024755	
7	4A1D3c08a	134.0140954	
8	4A1D3c03d	333.0241191	
9	4A1D3c03b	575.8904188	
10	4A1D3c03c	304.7938495	
11	4A1D3c07d	35.29478781	
12	4A1D3c03a	1043.968339	
13	4A1D3c01b	166.7927363	
14	4A1D3c07c	4.10715131	
15	4A1D3c02d	468.5329619	
16	4A1D3c02a	236.2626465	
17	4A1D3c01c	405.79749	
18	4A1D3c02b	347.2051171	
19	4A1D3c01a	310.7103503	
20	4A1D3c02c	712.378177	
21	4A1D3b07c	364.1595244	
22	4A1D3b06a	373.2051084	
23	4A1D3b06c	603.7102981	
24	4A1D3b06b	148.9006539	
25	4A1D3b07b	370.2794527	
26	4A1D3b07a	572.7084651	
27	4A1D3b05d	820.8110474	
28	4A1D3b05a	1.071241783	
29	4A1D3b05c	380.0848876	
30	4A1D3b05b	172.9598391	

TABLE 30. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER GRIDHAMBAL MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	GP Name	Ridge Type
1	Anaiseri	Lower
2	Athikulam	
3	Keelakanchirankulam	
4	Keelakodumalur	
5	Keelakulam	
6	Keeranur	
7	Manaloor	
8	Melakkanniseri	
9	Melakodumalur	
10	Nallur	
11	Selvanayagapuram	
12	Sirugudi	
13	Vikkiramapandiapuram	
14	Vilakkanenthal	

TABLE 31. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER GRIDHAMBAL MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	93
2	Afforestation in Public/common lands (ha)		92.59
3	Drainage Line Treatment (m)		1065
4	Block Plantation (Community) (ha)		339.61
5	Avenue plantation (km)		53.65
6	Composting (No.)		209
7	Canal Bund Plantation (km)		32.64
8	Restoration of water bodies: Tanks and Ooranis (No.)		57
9	Artificial Recharge Structure (No.)		291
10	Farm Bunding with Boundary Trenches - Individual (ha)		719.72
11	Construction of Farm Ponds - Individual (No.)		209
12	Land development - Individual (ha)		261.72
13	Azolla units - Individual (No.)		22
14	NADEP Vermi compost (No.)		22
15	Fodder development - Community & Individual (No.)		22
16	Cattle Shelters (No.)		22
17	Goat Sheep Shelters (No.)		949
18	Cattle Trough (No.)		22
19	Soak Pits (Community) (No.)		75
20	Soak Pits (Individual) (No.)		755
21	Roof Rain Water Harvesting (No.)		24
22	Poultry Shed (No.)		190
23	Nutri Garden (No.)		14
24	Silt application (No.)		128
25	Mini Forest (No.)		29

TABLE 32. MICRO-WATERSHED FALLING UNDER LOWER VAIGAI (3) MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2A2a06a	290.6732746	Lower
2	4A2A2a03c	101.1622544	
3	4A2A2a03a	35.62575369	
4	4A2A2a03b	533.0907298	

TABLE 33. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (3) MACRO-WATERSHED IN MUDUKU-LATHUR BLOCK

S.No	GP Name	Ridge Type
1	Nallukurichi	Lower
2	Sathanur	

TABLE 34. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (3) MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	193
2	Afforestation in Public/common lands (km)		19.31
3	Drainage Line Treatment (km)		42.1
4	Block Plantation (Community) (ha)		39.05
5	Avenue plantation (km)		11.5
6	Composting (No.)		58
7	Canal Bund Plantation (km)		14.3
9	Restoration of water bodies: Tanks and Ooranis (No.)		21
10	Artificial Recharge Structure (No.)		23
11	Farm Bunding with Boundary Trenches - Individual (ha)		182.25
12	Construction of Farm Ponds - Individual (No.)		58
13	Land development - Individual (ha)		71.86
14	Dryland Horticulture/Agroforestry - Individual (ha)		91
15	Azolla units - Individual (No.)		40
16	NADEP Vermi compost (No.)		40
17	Fodder development - Community & Individual (No.)		40
18	Cattle Shelters (No.)		40
19	Goat Sheep Shelters (No.)		210
20	Cattle Trough (No.)		40
21	Soak Pits (Community) (No.)		11
22	Soak Pits (Individual) (No.)		114
23	Roof Rain Water Harvesting (No.)		4
24	Poultry Shed (No.)		30
25	Nutri Garden (No.)		2
26	Silt application (No.)		29
27	Mini Forest (No.)		3

TABLE 35. MICRO-WATERSHED FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A2A1d12b	271.5459226	Lower
2	4A2A1d05c	183.6790567	
3	4A2A1d05d	357.9915532	
4	4A2A1d12a	32.94042884	
5	4A2A1d12c	604.6523143	
6	4A2A1d09a	417.9339248	
7	4A2A1d11c	860.0331747	
8	4A2A1d11b	163.2531076	
9	4A2A1d11a	3.15609373	
10	4A2A1d10c	4.588698534	
11	4A2A1d10b	7.016065673	

TABLE 36. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	GP Name	Ridge Type
1	Kolunthurai	Lower
2	Sellur	
3	Siruthalai	
4	Thiruvarangam	

TABLE 37. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER LOWER VAIGAI (4) MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Proposed Work	Ridge Type	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	61.8
2	Afforestation in Public/common lands (ha)		6.18
4	Block Plantation (Community) (ha)		147.23
5	Avenue plantation (km)		10.3
6	Composting (No.)		39
7	Canal Bund Plantation (km)		50.7
9	Restoration of water bodies: Tanks and Ooranis (No.)		11
10	Artificial Recharge Structure (No.)		39
11	Farm Bunding with Boundary Trenches - Individual (ha)		110.37
12	Construction of Farm Ponds - Individual (No.)		39
13	Land development - Individual (ha)		47.84
14	Dryland Horticulture/Agroforestry - Individual (ha)		55
15	Azolla units - Individual (No.)		6
16	NADEP Vermi compost (No.)		6
17	Fodder development - Community & Individual (No.)		6
18	Cattle Shelters (No.)		6
19	Goat Sheep Shelters (No.)		239
20	Cattle Trough (No.)		6

21	Soak Pits (Community) (No.)	Lower	25
22	Soak Pits (Individual) (No.)		240
23	Roof Rain Water Harvesting (No.)		6
24	Poultry Shed (No.)		64
25	Nutri Garden (No.)		4
26	Silt application (No.)		19
27	Mini Forest (No.)		10

TABLE 38. MICRO-WATERSHED FALLING UNDER THERKKU UPPER MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Micro-watershed Code	Micro-watershed Area in ha	Ridge Type
1	4A1D6c10c	331.2610959	Lower
2	4A1D6c10d	298.4571835	
3	4A1D6c10b	324.9195026	
4	4A1D6c10a	818.552627	
5	4A1D6c09c	719.4070024	
6	4A1D6c08b	460.9371987	
7	4A1D6c07e	405.9819918	
8	4A1D6c09d	525.4403027	
9	4A1D6c09b	522.7465876	
10	4A1D6c07c	797.0680999	
11	4A1D6c09a	438.3187705	
12	4A1D6c07b	676.1929252	
13	4A1D6c08a	521.8798909	
14	4A1D6c07d	425.0477386	
15	4A1D6c05d	1198.896155	
16	4A1D6c05c	572.6028506	
17	4A1D6c06c	543.95017	
18	4A1D6c06d	623.7715258	
19	4A1D6c07a	711.8795137	
20	4A1D6c06b	558.9128064	
21	4A1D6c05b	228.5172383	
22	4A1D6c05a	1498.207301	
23	4A1D6c04c	547.6635588	
24	4A1D6c04d	508.8321271	
25	4A1D6c06a	999.300008	
26	4A1D6c03b	779.8747712	
27	4A1D6c04b	752.2480312	
28	4A1D6c04a	713.9952064	
29	4A1D6b07e	717.6336628	
30	4A1D6b07d	278.3272637	
31	4A1D6b07b	132.5084118	
32	4A1D6c03a	476.5182882	
33	4A1D6b05c	399.5519196	
34	4A1D6b05b	1005.713928	

35	4A1D6b07c	106.1288536	Lower
36	4A1D6b03a	833.2753151	
37	4A1D6b03b	756.5328873	
38	4A1D6c02c	274.2575494	
39	4A1D6c02a	0.153283361	
40	4A1D6b02a	576.8207528	
41	4A1D6b06b	95.27197971	
42	4A1D6b05a	274.9378614	
43	4A1D6b07a	4.712824795	
44	4A1D6b03c	853.6611667	
45	4A1D6c02b	35.05346988	
46	4A1D6b03d	165.4496187	
47	4A1D6b02b	497.6133947	
48	4A1D6b01a	235.1233074	
49	4A1D6b02d	69.28434697	

TABLE 39. LIST OF GPs WITH TYPE OF RIDGE FALLING UNDER THERKKU UPPER MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	GP Name	Ridge Type
1	Alangaanoor	Lower
2	Arapothu	
3	Athanakurichi	
4	Athankothankudi	
5	Kakkur	
6	Karumal	
7	Kathakulam	
8	Keelathooval	
9	Kumarakurichi	
10	Makindi	
11	Michealpattanam	
12	Periya Ilai	
13	Pirabukkalur	
14	Ponnakkaneri	
15	Pooseri	
16	Posukkudi	
17	Pulithikulam	
18	Puliyangudi	
19	Sambakulam	
20	Semponkudi	
21	S.R.N.Palankulam	
22	Theriruveli	
23	Ulaiyur	
24	Valanadu	
25	Vengalakurichi	
26	Vilankulathur	

TABLE 40. LIST OF WORKS PROPOSED UNDER CWRM – WASCA WITH TYPE OF RIDGE FALLING UNDER THERKKU UPPER MACRO-WATERSHED IN MUDUKULATHUR BLOCK

S.No	Name of the Work Proposed	Type of Ridge	Extent
1	Contour Continuous Bunds (CCB) for Afforestation area (m)	Lower	2,477
2	Afforestation in Public/common lands (ha)		247.73
3	Drainage Line Treatment (m)		143
4	Block Plantation (Community) (ha)		987.54
5	Avenue plantation (km)		117.8
6	Composting (No.)		318
7	Canal Bund Plantation (km)		62.4
9	Restoration of water bodies: Tanks and Ooranis (No.)		250
10	Artificial Recharge Structure (No.)		286
11	Farm Bunding with Boundary Trenches - Individual (ha)		997.3
12	Construction of Farm Ponds - Individual (No.)		318
13	Land development - Individual (ha)		396.92
14	Dryland Horticulture/Agroforestry - Individual (ha)		499
15	Azolla units - Individual (No.)		44
16	NADEP Vermi compost (No.)		44
17	Fodder development - Community & Individual (No.)		44
18	Cattle Shelters (No.)		44
19	Goat Sheep Shelters (No.)		1,562
20	Cattle Trough (No.)		44
21	Soak Pits (Community) (No.)		175
22	Soak Pits (Individual) (No.)		1,741
23	Roof Rain Water Harvesting (No.)		48
24	Poultry Shed (No.)		275
25	Nutri Garden (No.)		24
26	Silt application (No.)		396.92
27	Mini Forest (No.)		57

8.2 MODEL MICRO-WATERSHED- VENGALAKURICHI

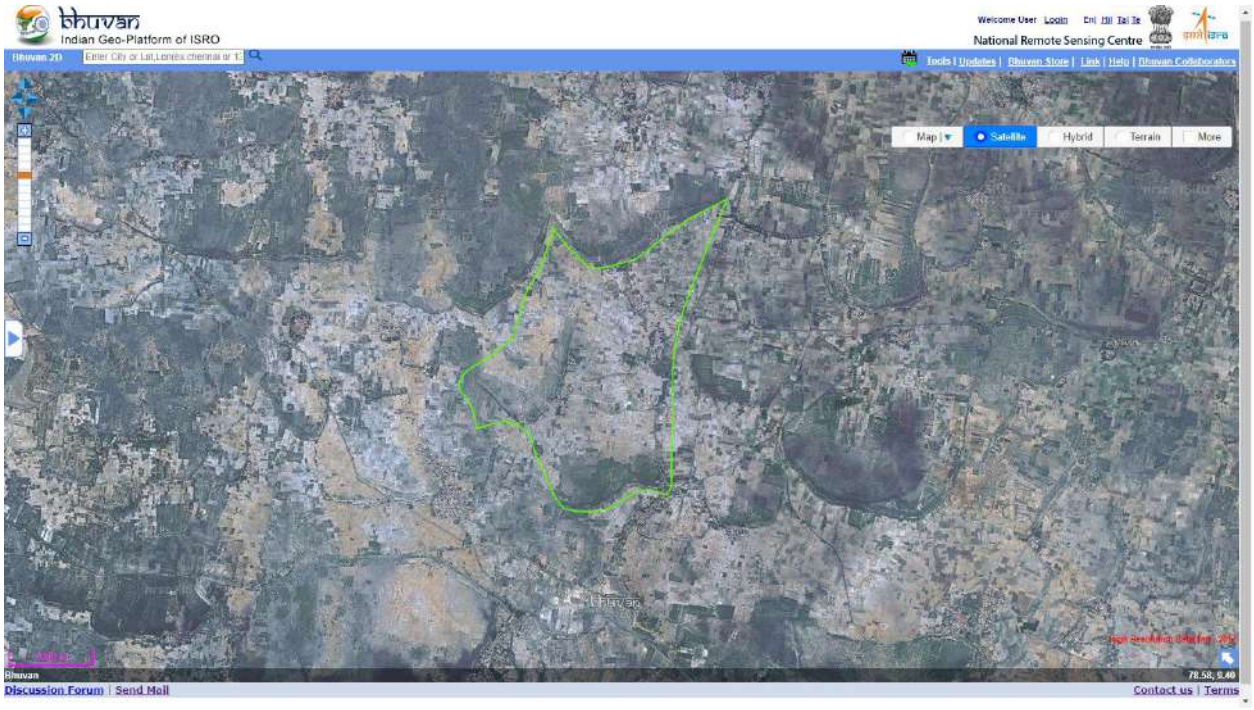


Figure 8.3. Satellite image of Vengalakurichi micro-watershed

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

ABOUT VENGALAKURICHI MICRO-WATERSHED

Vengalakurichi micro-watershed falls under Kadalur and Chithoorvadi GPs, in Mudukulathur Block, Ramanathapuram District. The satellite image of the micro-watershed is shown in Figure 8.3. This micro-watershed is the part of Kottakkaraiyar macro-watershed in Kottakkaraiyar sub-basin. The general information, geology, hydrogeology, natural drainage line, catchment area, ground water status, water budget of Vengalakurichi micro-watershed is given below in separate sections followed by proposed works, ridge wise proposed treatment area, estimated cost and required person days and key outcomes. (Table 41 to 52 & Figure 8.4). The key CWRM parameters for the GPs falling in this micro-watershed is given in Annexure 8.

TABLE 41. GENERAL INFORMATION OF THE MICRO-WATERSHED

Description	Name/ Number/ Quantity/ Status
Name of the Micro-watershed	Vengalakurichi Micro-watershed
Micro-watershed Number	4A1D6c06d
Name of the Basin	Gundar Basin
Name of the sub basin	Gundar Sub Basin
Name of the Macro-watershed	Therkku Upper
Number of GPs covered under the Micro-watershed	1
Name of the GP	Vengalakurichi
Latitude of Micro-watershed (From To)	9°22'17.121"N to 9°24'17.025"N
Longitude of Micro-watershed (From To)	78°30'52.289"E to 78°32'34.387"E
Total area of the Micro-watershed in ha	623.77
% of Micro-watershed area in Vengalakurichi GP	100
Area of Micro-watershed falling in Vengalakurichi GP (ha)	623.77 ha
Total Population of Vengalakurichi GP	3,392
Annual Average Rainfall (mm)	821
Annual maximum Temperature (°C)	32.6
Annual Minimum Temperature (°C)	23.8
Evapo-transpiration Losses of Vengalakurichi GP (ha.m)	33.97
Volumetric soil moisture availability (%)	17
Climate Risk	Drought
CVI Index Value for Vengalakurichi (Based on WASCA Climate study)	0.531 (High Water Vulnerability)
Agro-Climatic Zone	Southern Zone (TN 05)
Agro Ecological Sub-Region (ICAR)	Hot dry semi-arid eco sub region (18.1)
Status of Ground water in Vengalakurichi GP	Safe

TABLE 42. HYDROGEOLOGY & OTHER CHARACTERISTICS IN MICRO-WATERSHED

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

TABLE 43. EXISTING WATER HARVESTING STRUCTURES IN VENGALAKURICHI GP

Sl.No.	Name of Structure	Vengalakurichi GP
		Existing Structures
		No.
1	Oorani	8
2	Tanks	2
3	Farm Ponds	-
	Total	**10**

TABLE 44. CATCHMENT AREA OF MICRO-WATERSHED

Catchment Area in ha	Vengalakurichi GP
Good catchment area	227
Average catchment area	33
Bad catchment area	959

TABLE 45. GROUND WATER STATUS OF MICRO-WATERSHED

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

TABLE 46. SALINITY AND SEA WATER INTRUSION IN THE MICRO-WATERSHED

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

TABLE 47. WATER BUDGET OF GP'S FALLING IN MICRO-WATERSHED- VENGALAKURICHI GP

Water Budget in ha.m	Vengalakurichi GP
Water for human	9.29
Water for agriculture	736.7
Water for livestock	0.94
Village wise water required	747.00
Available run-off from rain water (derived from Strange method)	165
Harvested Runoff from Water Harvesting Activities	861.5
Potential Harvesting from proposed Interventions	102.0
Total Water harvested	963.5
Water demand and Supply Difference	-216.5
Water demand supply gap status	Deficient
Per capita Water Availability in cum	736.5

International Standard per capita water Availability (cum)	1,700
Water Availability Gap (cum)	-644.98
Water security status	Water Stress

TABLE 48. GP WISE PROPOSED MICRO-WATERSHED WORKS – VENGALAKURICHI GP

Proposed Work	Vengalakurichi GP
Proposed works in Upper Ridge	0
Proposed works in Middle Ridge	0
Proposed works in Lower Ridge	70
Total works	**70**

TABLE 49. RIDGE WISE TREATMENT AREA ESTIMATED COST AND PERSON DAYS REQUIRED- VENGALAKURICHI GP

Ridge Type	Vengalakurichi GP
Lower Ridge	
Estimated cost for Lower Ridge area (INR in Lakhs)	159.50
Total area in ha of Lower Ridge	623.77
Estimated Person days generated for Treatment of Lower Ridge	**57,178**
Treatment cost of Lower Ridge Lakhs/ha	**0.256**

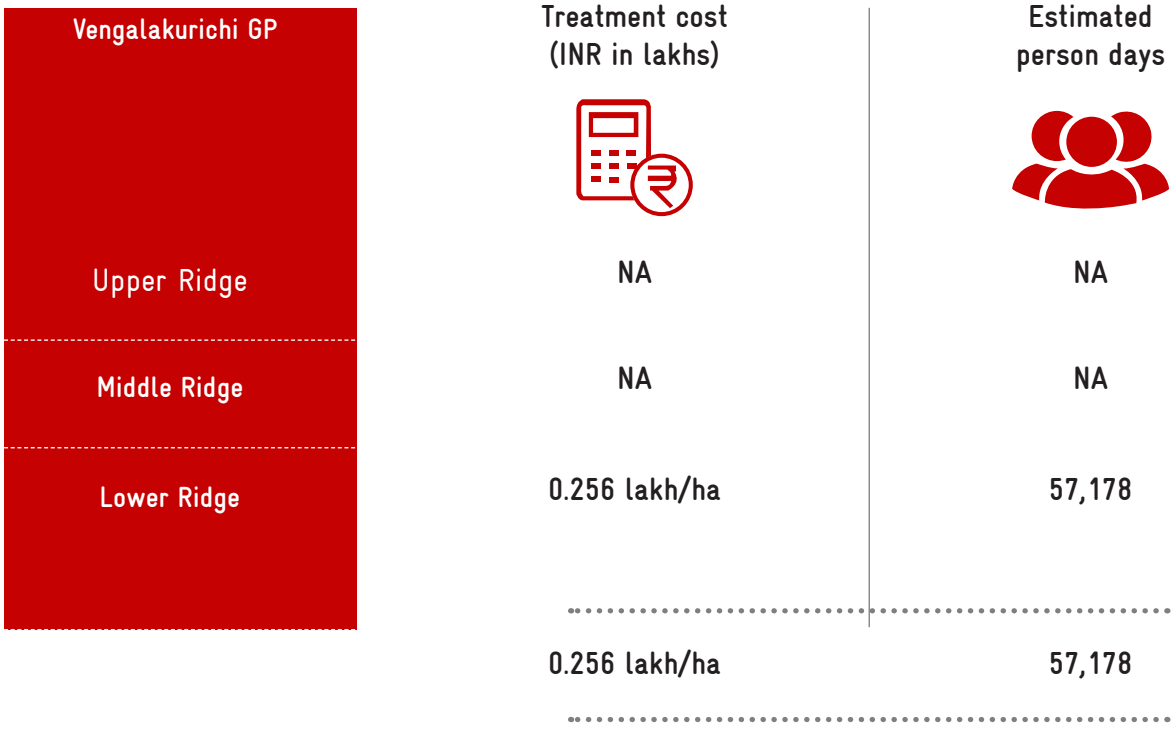
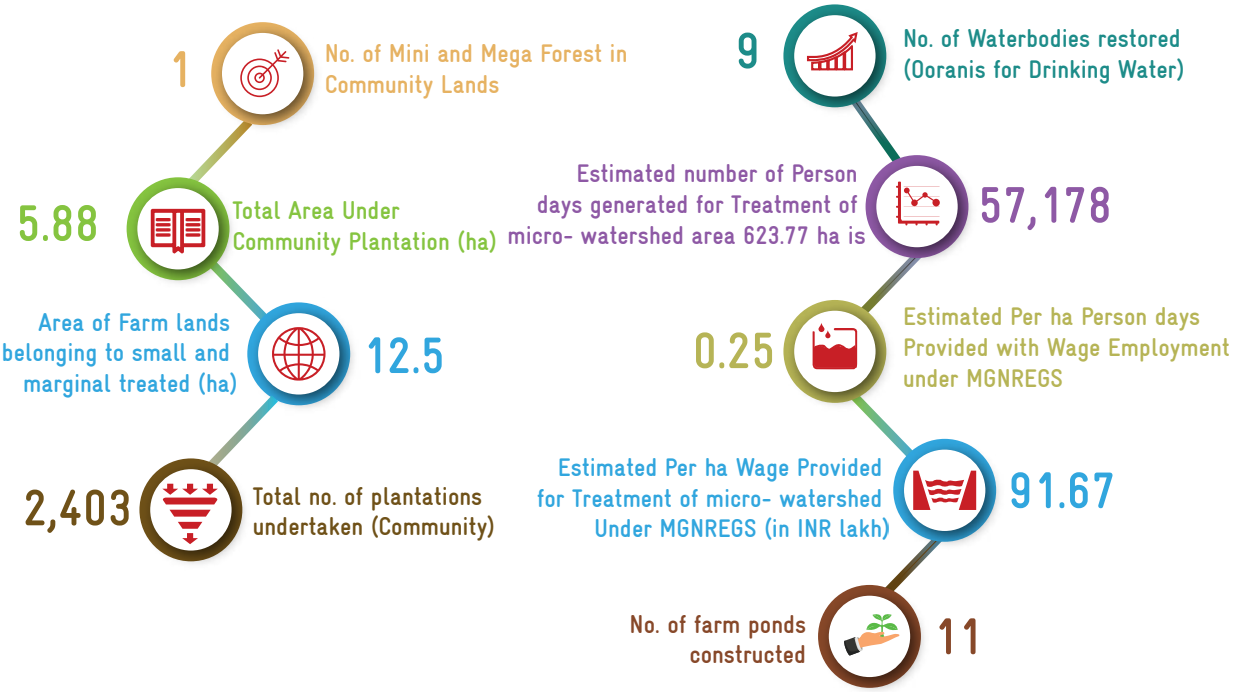


TABLE 50. NATURE AND NO. OF WORKS IN MICRO-WATERSHED

Description	Number
Total No. of works in Micro-watershed area (Arable, Non arable & DLT)	54
Total No. of works in Micro-watershed including livelihood Activities	8
Total No. of works in Micro-watershed including Rural Greywater Management Activities	8

TABLE 51. KEY OUTCOMES OF INTERVENTION



Expenditure for FY 2020-21 (in INR lakh)

Vengalakurichi GP	84.63 lakh

TABLE 52. ESTIMATES OF MICRO-WATERSHED IN VENGALAKURICHI GP

Name of the Work Proposed	Type of Ridge	Status of Work	Extent	No. of works as per KML	Estimate cost (INR in Lakhs)	Person days
NRM works in Public and Community Lands						
Restoration of Traditional water bodies: (Oorani & Tank) (No.)	Lower	Not commenced	9(7+2)	9	69	25,126
Oorani bund Plantation (No.)			1,903	9	8.75	3,190
Avenue plantation (km)			7.2	3	1.53	543
Block Plantation (ha)			3.12	1	8.97	3,269
Afforestation (ha)			2.76	1	7.94	2,890
Dry Land Horticulture (No.)			1	1	5	1,794
Mini Forest (No.)		Completed	500	1	5.75	3,950
Roof Rain Water Harvesting in GP Building (No.)		Not commenced	1	1	0.3	15
Sub total				**26**	**107.24**	**40,777**
Works in Individual Farmer lands (Agriculture and Allied Activities)						
Recharge Shaft for bore well farmers for Salinity Reduction (No.)	Lower	Not commenced	5	5	1.35	60
Farm Bunding with Boundary Trenches - Individual (ha & No.)			12.5			
Construction of Farm Ponds - Individual (No.)			5	5	18.75	6,786
Composting (No.)			11	11	19.8	6,820
NADEP Vermi compost (No.)			5	5	0.45	155
Fodder development - Individual (No.)			1	1	0.12	5
			1	1	1.48	2,344
Sub total				**28**	**41.95**	**16,170**
Total no. of works for treatment of micro-watershed (Arable, Non arable & DLT)				**54**	**149.19**	**56,947**
Livelihood enhancement activities for Individual Farmers (Coastal Area)						
Azolla Production Unit (No.)	Lower	Not commenced	1	1	0.15	14
Cattle Shelters (No.)			1	1	1.6	33
Poultry Shed (No.)			2	2	4	44
Goat Sheep Shelters (No.)			3	3	3.45	90
Cattle Trough (No.)			1	1	0.2	11
Sub total				**8**	**9.4**	**192**
Rural Greywater and Roof Rainwater Management						
Soak Pits (Individual) (No.)	Lower	Not commenced	2	2	0.216	12
Soak Pits (Community) (No.)			3	3	0.39	24
Nutri Garden (No.)			3	3	0.3	3
Sub total				**8**	**0.906**	**39**
Total no. of works under Vengalakurichi GP for Micro-watershed development (IWRM)				**70**	**160**	**57,178**

TOTAL ESTIMATES OF MICRO-WATERSHED IN VENGALAKURICHI GP

	No. of works as per KML	Estimate cost in INR (Lakhs)	Person days
Vengalakurichi GP	70	160	57,178

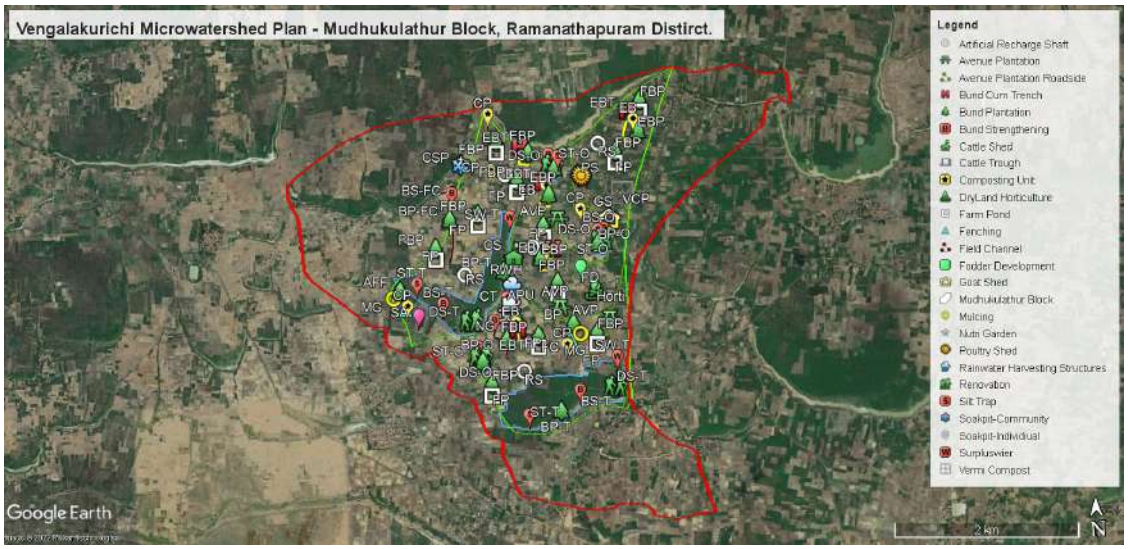


Figure 8.4. Proposed activities in Vengalakurichi Micro-watershed

8.3 MODEL GP - KEELAKANGIRANKULAM

BACKGROUND OF GRAM PANCHAYAT - KEELAKANGIRANKULAM

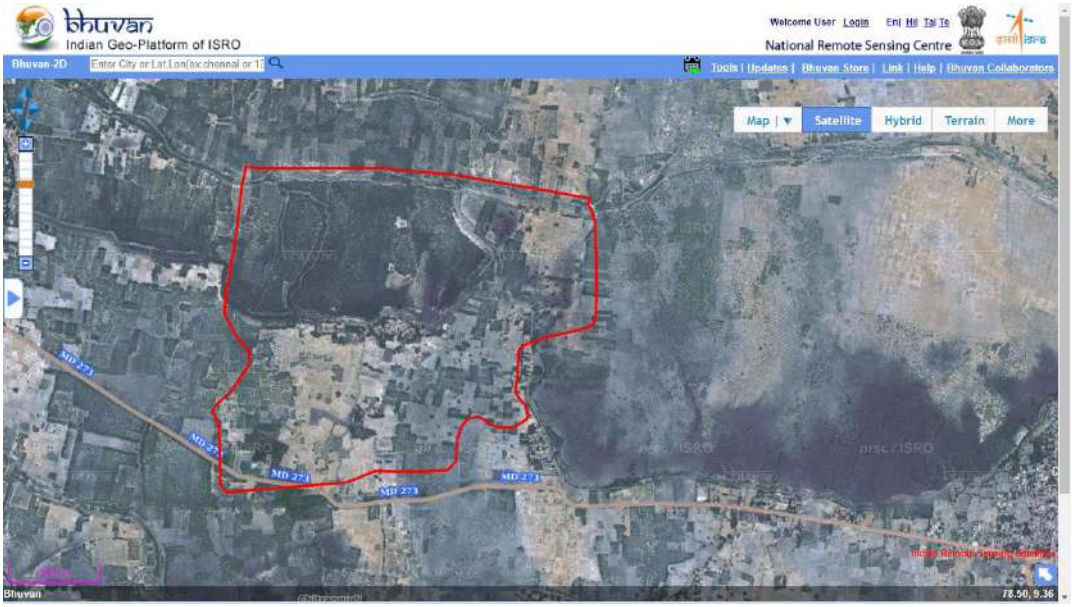
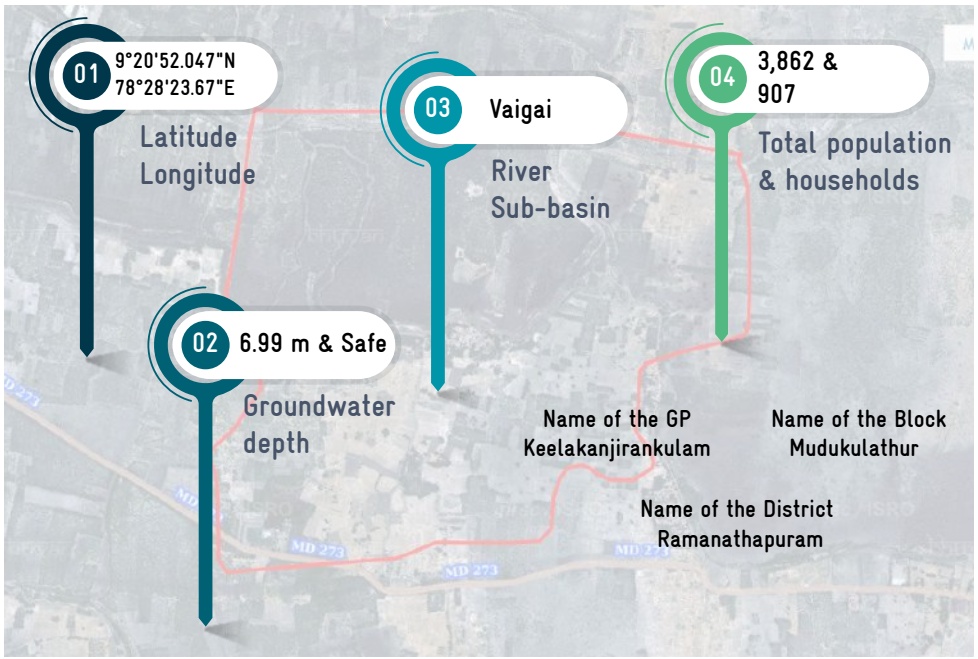


Figure 8.5. Satellite Image of Keelakangirankulam GP

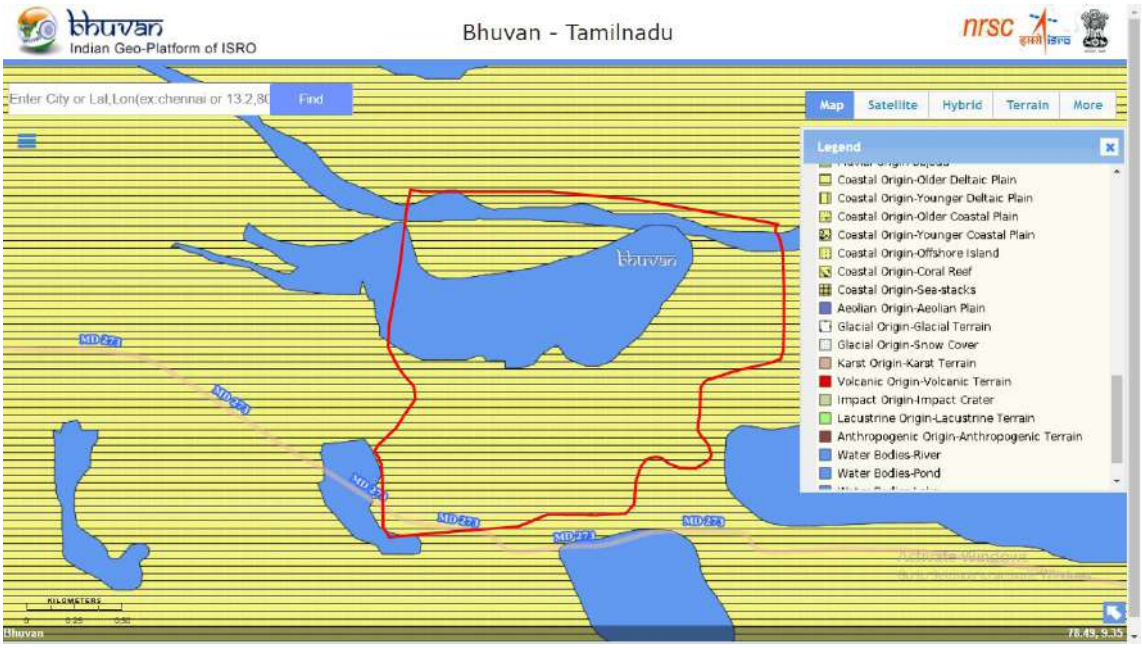
Keelakangirankulam GP is located in Mudukulathur Block of Ramanathapuram District, Tamil Nadu. The total geographic area of this village is about 291 ha. As per the Population Census 2011, the total population of the GP is 3,862 out of which 1,939 are males, 1,923 are females. There are 907 HHs in the village. 39.82% of the population comprises of SC population. There is no ST population. (Table 53)

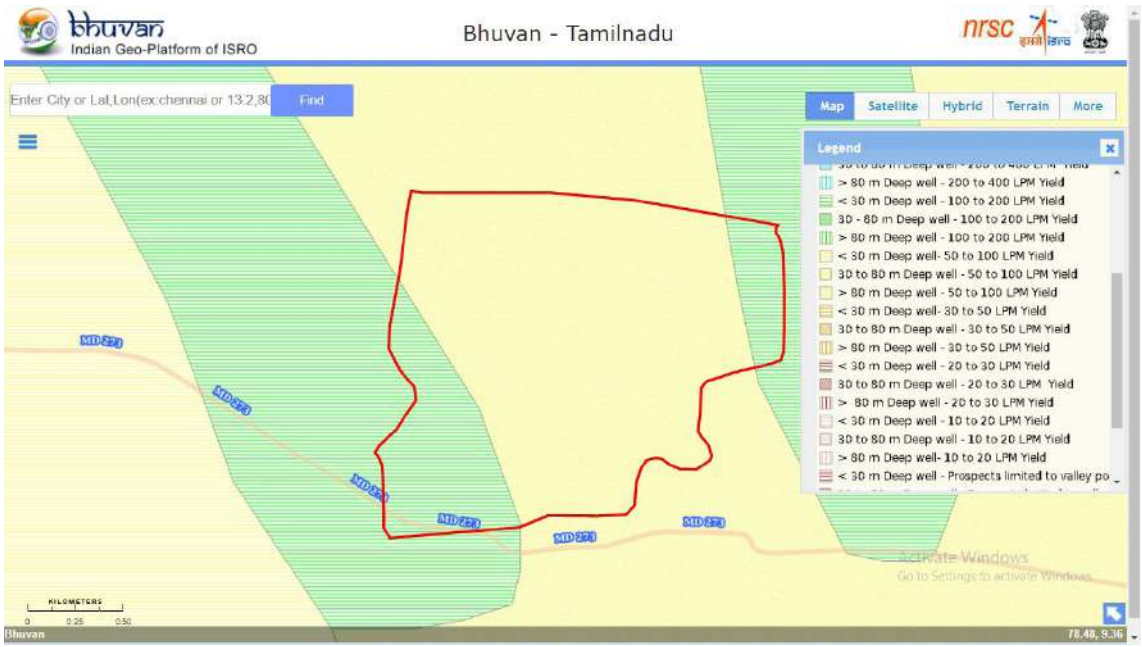
TABLE 53. GENERAL DESCRIPTION OF KEELAKANGIRANKULAM GP, MUDUKULATHUR BLOCK



8.3.1 CWRM PLANNING - SPATIAL DATA

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





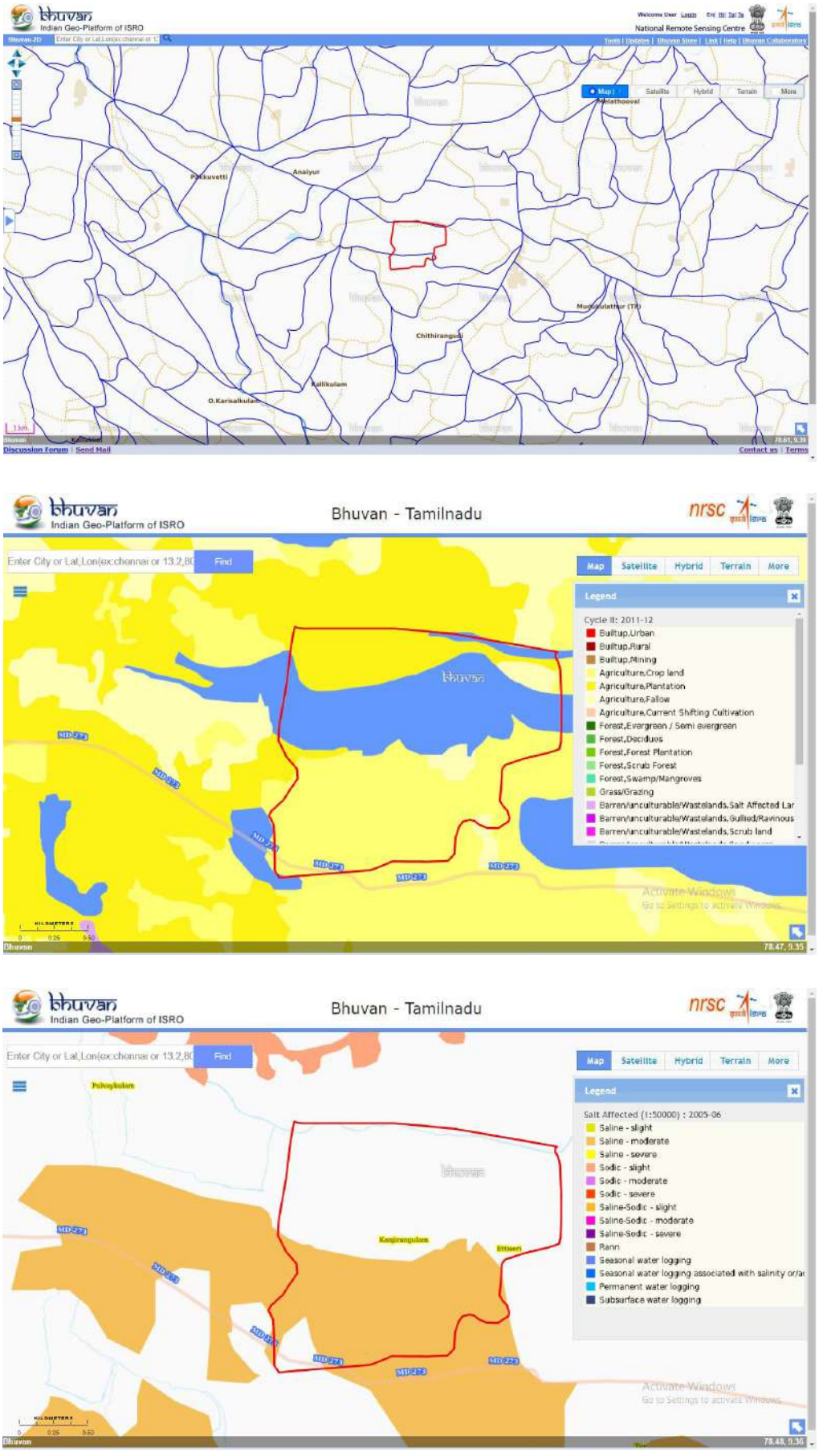


Figure 8.6. Spatial thematic maps of Keelakangirankulam GP. A. Geomorphology, B. GW prosperity, C. Watershed, D. LULC, E. Salt affected area

Keelakangirankulam GP is under Coastal Origin- Deltaic Plain with the River flowing in part of the GP (A). The groundwater prospectus of the middle part of the GP is 30-80 m deep well and 50 to 100 liters per minute yield and both sides have < 30m Deep well – 100 to 200 liters per minute (B). GP area is falls under two micro-watershed units (C). 20 % of area is used for agriculture and about 50 % is the agriculture fallow land and rest is the wet land (D). The one third of GP area affected for moderate salinity (E).

8.3.2 CWRM PLANNING- NON-SPATIAL DATA

The non-spatial data covered four important themes – socio economic, climate, water and agriculture with 116 parameters (Table 54). These non-spatial data are concurrently used for analysis along with the spatial data mentioned above to identify the key water challenges, prepare water budget by understanding the supply and demand and develop water actions to the different land use and slope categories. The process starts with mapping of the administrative (habitations/panchayat/revenue village, Block/taluk), agro-ecological (regional and sub-regional, climatic and agricultural zonation's) and hydrological (drainage points/watersheds/sub basin) units keeping the GP as the lowest unit of planning and execution.

TABLE 54. NON-SPATIAL DATA-KEELAKANGIRANKULAM GP

Key CWRM Parameter	Details
Socio-Economic	
Geographical Area (ha)	291
Male Population	1,939
Female Population	1,923
Total Population	3,862
SC Population	1,538
ST Population	0
Vulnerable Population	1,538
Households (HH's)	907
Only one room HH's (SECC)	363
Female Headed HH's (SECC)	72
Vulnerable Households (SECC)	276
% of Vulnerable Households	30
Registered MGNREGA Job cards	445
The active person working in job Cards	324
Drinking Water Sources	35
HH's have tap water connection for drinking water	140
HH's dependent on other sources for drinking water	200
Annual Greywater Generation (ha.m)	7.05
Water Resources	
Canal Network (km)	
Length of Main Canal	2,500
Length of Distributaries	229
Water Courses (Field Channels)	7,500

No.of Tanks (PWD & Union)	1
No. of Ooranis	5
Irrigation Facilities (ha)	
Area under Tank Irrigation	242.81
Area under Open & Tube Well Irrigation	68
Catchment Area wise Available Runoff (ha.m)	
Good Catchment Area	12.4
Average Catchment Area	0.6
Bad Catchment Area	22.8
Watershed and Drainage Networks	
Length of Natural Drainage Lines (km)	2,155
No. of Natural Drainage Lines	2
No. of Micro Watersheds	3
Water Demand (ha.m)	
Water Demand for Humans	11
Water Demand for Agriculture	678
% G.W Utilization for Drinking	91
% G.W Utilization for Livestock	49
% G.W Utilization for Agriculture.	22
% SW Utilization for Drinking	9
% SW Utilization for Livestock	51
% SW Utilization for Agriculture	78
Agriculture	
Land Resources (ha)	
Area under Non-Agricultural Uses	55.9
Area under Land Under Miscellaneous Tree Crops etc.	2.27
Area under Cultivable Waste Land	1.44
Area under Fallows Land other than Current Fallows	4.86
Area under Current Fallow land	1.09
Area under Unirrigated Land	126.47
Area Irrigated by Source	68.25
Catchment Area wise Available Runoff (ha.m)	
Land under Good Catchment	55.9
Land under Average Catchment	3.71
Land under Bad Catchment	200.67
Crop Details (ha)	
Irrigated Area	266.84
Rainfed area	303.74
Area under Paddy Cultivation	526.11
Crop Water Requirement - Irrigated condition (ha.m)	389.54

Crop Water Requirement - Rainfed condition (ha.m)	288.4
Soil Resources: Status of Available Nitrogen (%)	
Very Low	86
Low	14
Status of Organic Carbon (%)	
Very Low	69
Low	20
Medium	6
High	5
Status of Soil Micro Nutrients (%)	
Sufficient	59
Deficient	41
Status of Physical condition of the soil (%)	
Highly Acidic	1
Moderately Acidic	4
Slightly Acidic	4
Neutral	3
Moderately Alkaline	71
Strongly Alkaline	18
Soil Texture	
% of Fine Soil	24
% of Coarse loamy	48
Soil Water Permeability	Moderate to Low (5-20 mm/hr)
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture (ha.m)	34.74
ET Losses (ha.m)	102.83
Means of Water Extraction (%)	
Gravity	18
Lifting	82
Irrigation Methods (%)	
Wild Flooding	78
Control Flooding	22
Livestock (No)	
Cattle Population	48
Sheep Population	277
Goat Population	190
Poultry	384
Livestock Water Requirement (ha.m)	0.35

8.3.3 KEY WATER CHALLENGES

Socio-Economic

1. Female population almost equal to male population
2. 39.82 % of the population belong to the SC category, according to SECC data
3. 30% of the households are vulnerable, 72 HH are female headed
4. 363 HH have only one room.
5. 7.05 ha.m grey water from 907 households living in the coast needs attention

Water

1. 5 Ooranis and 1 tank in the GP
2. 91% Ground Water utilized for drinking water purpose
3. 78% of surface water utilized for agriculture
4. More water for agriculture (678 ha.m)
5. 35.8 ha.m of water is an available runoff in which 63.68% of the runoff is from the bad catchment, 34.63 % of the conservation is from the good catchment

Agriculture and Allied Sector

1. 77.09 % is under Individual lands
2. More bad catchment area (77.09%)
3. Rainfed area (53.23%)
4. Very Low soil Nitrogen and Organic Carbon
5. 71 % moderately Alkaline
6. 48% coarse loamy soil, 24% fine soil
7. 78% Wild flooding
8. Area under paddy cultivation 526.11 ha

8.3.4 PERSPECTIVE PLAN - WORKS PROPOSED: WATER ACTIONS

The appropriate and site-specific works are identified for the development of public and common land, agriculture and allied activities, rural infrastructures, and climate-resilient measures to reduce the vulnerability in the GP. About 24.61% of the total land area is taken for WASCA activities like plantation, conservation works. The total proposed area for treatment is 64.06 ha out of which 93.99% of the proposed work is under individual lands and the rest (6.01%) is under common land (Figure 8.7). Through the proposed conservation activities, 17.89 ha.m run off would be harvested in which, about 57.68 % of the runoff is from the good catchment, 3.07% of the run off is from the average catchment and 39.23% is from the bad catchment area (Figure 8.8).

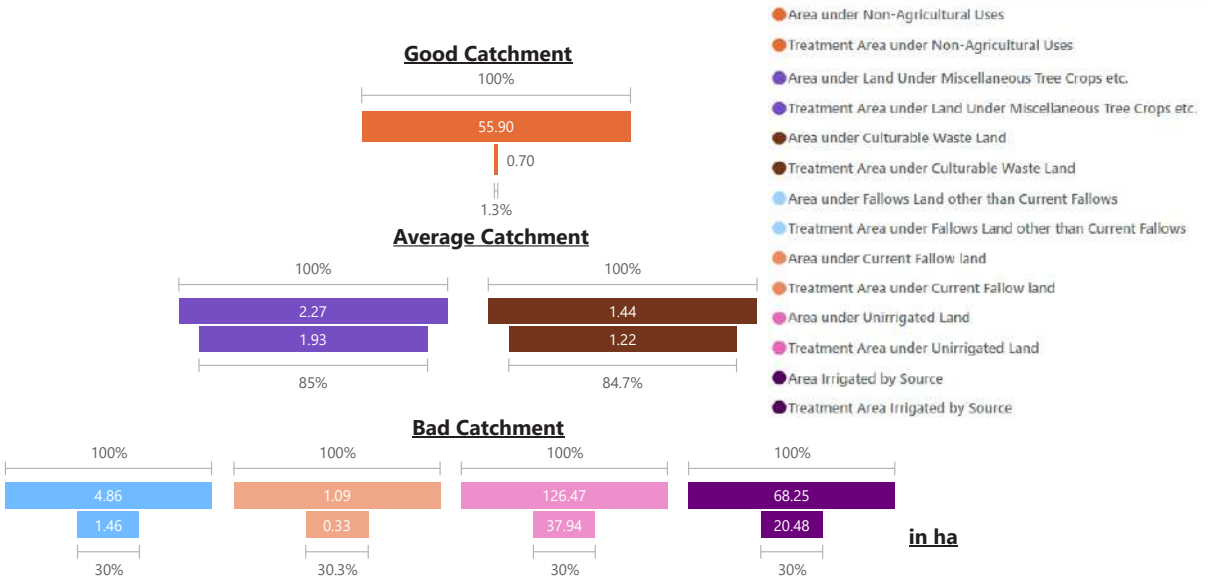


Figure 8.7. Proposed land resource treatment area in Keelakangirankulam GP

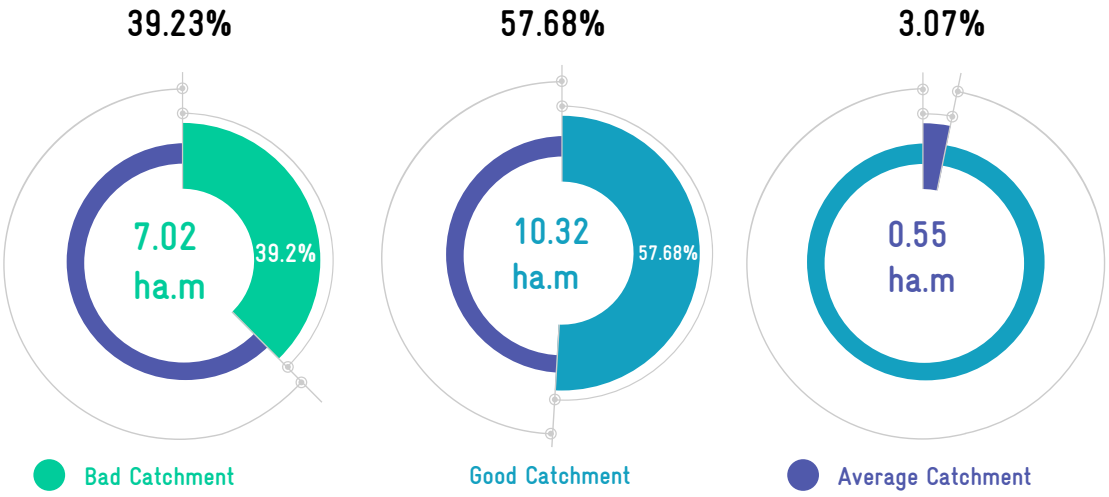


Figure 8.8. Expected run off conservation after treatment in Keelakangirankulam GP

Table 55 shows the detailed perspective plan and estimates of the work, budget, and person-days for three years from 2021-2022 to 2023-2024 in Keelakangirankulam GP. Since it is a vulnerable village, attention was given to include appropriate works to improve the common and public land development.

TABLE 55. PERSPECTIVE PLAN OF KEELAKANGIRANKULAM GP - FY (2021-2024)

CWRM Water Action 1: Improvement of Public & Common Lands Development				
CWRM Water Action 1: Works in Upper& Middle Ridge				
Name of the Work	**Ridge Type**	**No of Works**	**Estimated cost (INR in Lakhs)**	**Estimated Person Days**
Afforestation in Public/common lands (ha)	Lower	0.7	6.02	2,340.8
Contour Continuous Bunds (CCB) for Afforestation area (m)		2.82	0.07	28.2
Composting (No.)		16	2.72	240
Drainage Line Treatment (m)		75	2.26	377
Avenue plantation (km)		0.881	1.59	619.343
Block Plantation (Community) (ha)		3.15	34.97	13,608
Restoration of water bodies (No.)		6	27	4,200
Artificial Recharge Structure (No.)		27	67.5	10,557
Canal Bund Plantation (km)		37	277.5	1,08,410
WC - Irrigation channels - Desilting		1	0.02	6
Subtotal Water Action - I		**170**	**420**	**1,40,386**
CWRM Water Action 2: Agricultural and allied Sector development				
Farm Bunding (ha)	Lower	60	90.3	35,277
Micro Irrigation (ha)		8	8	0
Construction of farm ponds (No.)		16	32	12,496
Land development (ha)		20	198.6	77,573
Cattle Shelters (No.)		1	2.12	331
Goat Sheep Shelters (No.)		26	59.02	9,230
Fodder development for cattle (No.)		1	1.48	2,344
Azolla units (No.)		1	0.15	23
Cattle Trough (No.)		1	0.05	6
Poultry shed (No.)		10	0.9	100
Dry land Horticulture/Agro-forestry (ha)		15	127.5	49,815
Vermi Compost (No.)		1	0.18	27
Subtotal Water Action - II		**160**	**520**	**1,87,222**

CWRM Water Action 3: Rural Water Management

Soak pits (Community) (No.)	Lower	9	1.17	180
Soak pits (Individual) (No.)		88	8.8	1,408
Roof rain Water Harvesting (No.)		2	8	1,250
Community Tanka (Rajasthan Model) (No.)		1	30	300
Subtotal Water Action - III		**100**	**47.97**	**3,138**
Overall Total GP		**430**	**988**	**3,30,747**

Water actions

Regarding CWRM themes, of the total number of projects identified, 39.53 percent works are in public and common land, 37.20 percent in agriculture and allied sector while it is 23.25 percent under rural infrastructure (Table 56).

TABLE 56. 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	170	420	1,40,386
Agriculture and Allied sector development	160	520	1,87,222
Rural water management	100	47.97	3,138
TOTAL	430	988	3,30,747

8.3.5 IMPACTS

The proposed water actions based on the above key water challenges cover three years from 2021-2022 to 2023-2024. At the end of the implementation period the following impacts are envisaged (Table 57). It is expected that the impacts have potentially reduced the vulnerability and improved the resilience of the system to the projected climatic change events and ensured water security.

TABLE 57. 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	6 water bodies restored
2	Quantum of water harvested/recharge	2	29.8 ha.m surface runoff is harvested due to WASCA interventions
3	The proportion of land treated under WASCA	3	24.6 percent of the total area treated under WASCA (107.60 ha)
4	Area under afforestation	4	0.7 ha area under afforestation
5	Length of drainage line treated	5	Nil

6
TRADITIONAL WATER BODIES RESTORED

0.7 ha
AFFORESTATION

29.8 ha.m
RUNOFF HARVESTED

24.6 %
AREA OF THE VILLAGE TREATED

WASCA CWRM ACTION PLAN

DEVELOPMENT OF AGRICULTURE AND ALLIED ACTIVITIES

	INDICATOR		OUTCOMES/ IMPACT
1	Assessment of sources of water for live-stock and agriculture demand	1	20.48 ha covered under micro-irrigation
2	No structures were established for on-farm (in-situ) water harvesting in drylands	2	16 farm ponds established
3	Improvement in soil health	3	15 compost units for soil health improve-ment
4	Changes in the irrigation practices	4	60.2 ha Farm bunding with trenches
5	Dryland development with agro-forestry	5	15 ha under dryland horticulture
6	Households established fodder plots	6	12 vulnerable households established fodder plots

16
FARM PONDS

15
VERMI COMPOST

60.2 ha
FARM BUNDING

15 ha
DRYLAND HORTICULTURE

12
FODDER PLOTS

WASCA CWRM ACTION PLAN

DEVELOPMENT OF RURAL INFRASTRUCTURE

INDICATOR	
1	No. of units having complete liquid waste management systems
2	Roof rainwater harvesting measures
3	Greywater drains
4	Nutri gardens

OUTCOMES/ IMPACT	
1	9 common and 88 individual soak pits were established for recycling greywater benefiting 882 households
2	2 common roof rainwater harvesting and storage and 882 individual level roof rainwater harvesting
3	Nill
4	882 Households established Nutri-gardens in homesteads

9 COMMUNITY & **88** INDIVIDUAL SOAK PITS

2 COMMON & **882** INDIVIDUAL ROOF RAINWATER HARVESTING

882 NUTRI-GARDENS

Table 58 provides both the prospective plan for three years and the annual plan for the one year from 2021-2022 on the shelf of projects/number of works and number of person-days.

TABLE 58. PROPOSAL FOR THE MGNREGS, T.KARUNGULAM GP, BOGALUR BLOCK

	No of works	No of person days
Perspective plan	430	3,30,747
Annual plan	172	1,32,299

8.3.6 PROPOSED ACTIVITY MAP

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

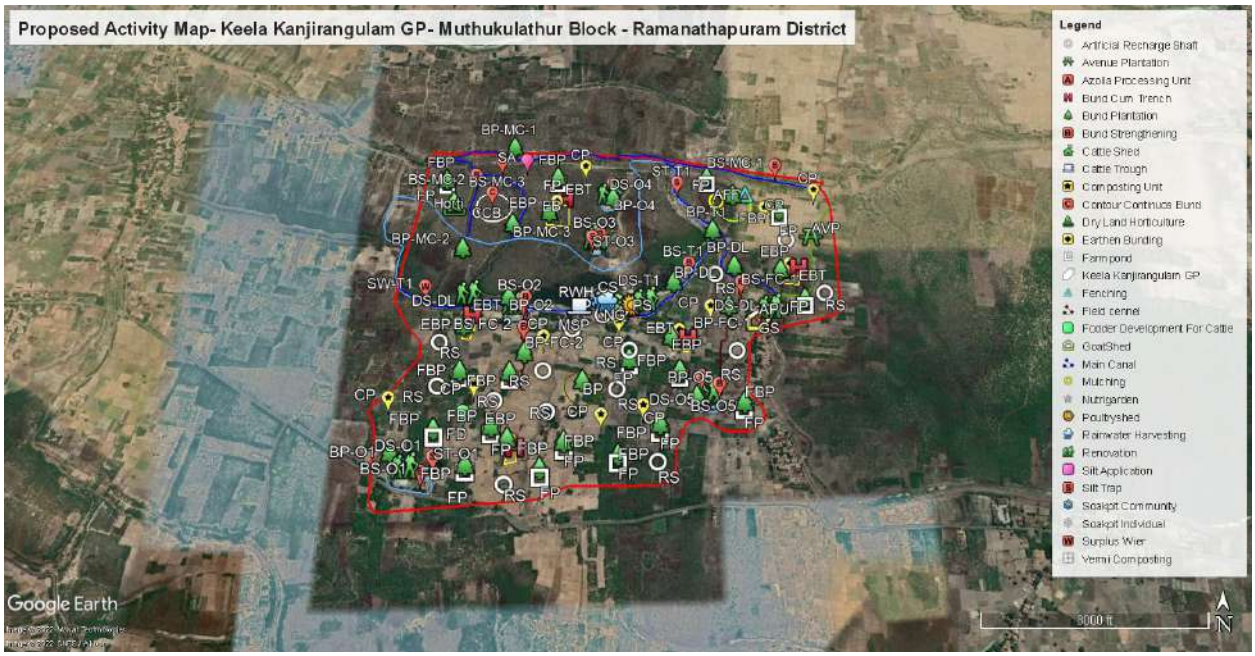
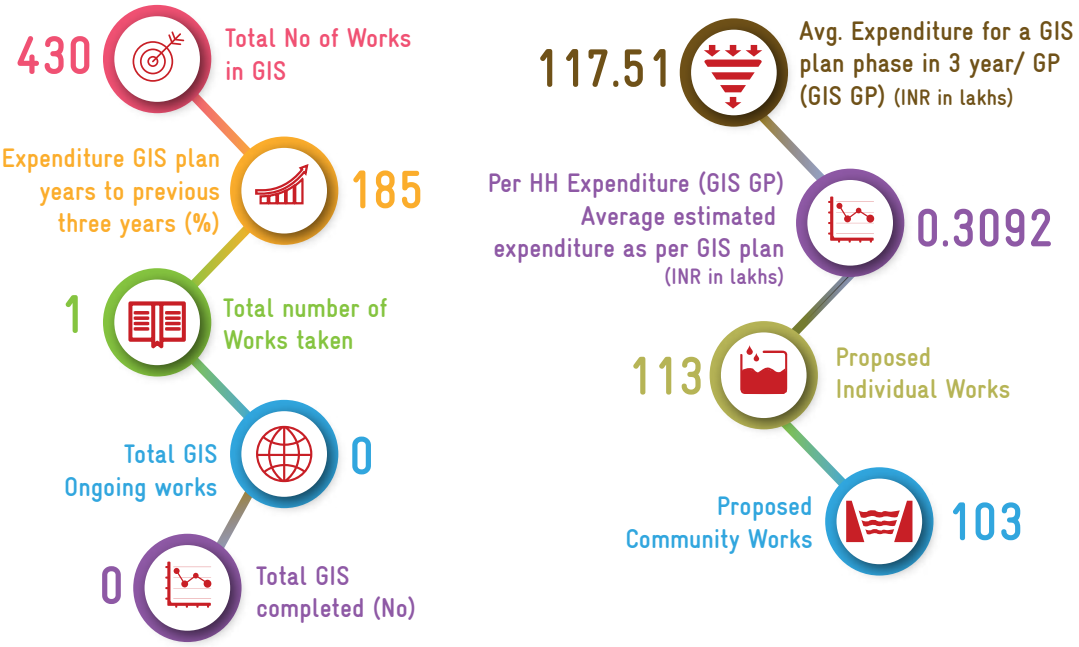


Figure 8.9. Proposed action plan of Keelakangirankulam GP

8.3.7 GIS PLAN IMPLEMENTATION AND KEY PARAMETERS

The GIS plan implementation and performance of Keelakangirankulam GP, Mudukulathur Block is represented in Table 59.

TABLE 59. GIS PLAN IMPLEMENTATION, KEY PARAMETERS PERFORMANCE IN NUMBERS



நீர்இன்று அமையாது உலகெனின் யார்யார்க்கும்
வான்இன்று அமையாது ஒழுக்கு

குறள் - 20

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

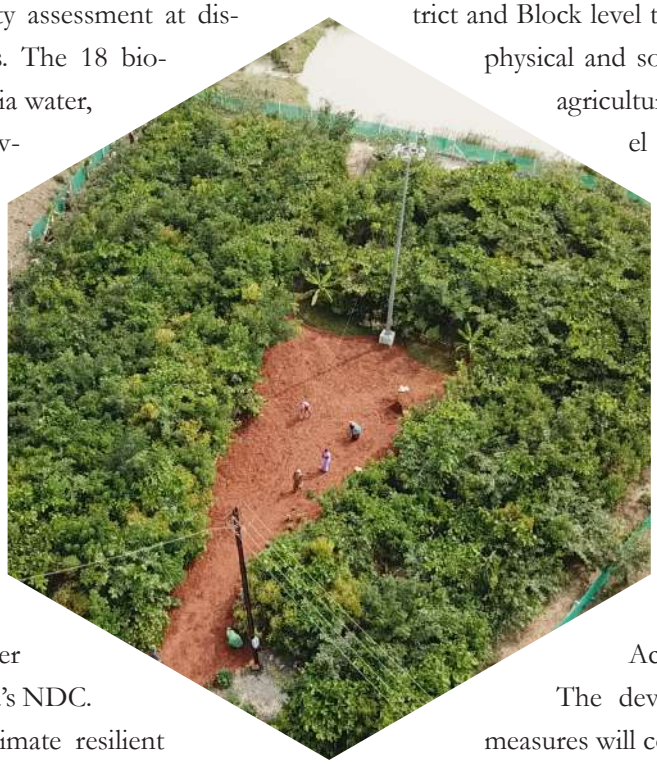
Thirukkural - 20

CHAPTER 9

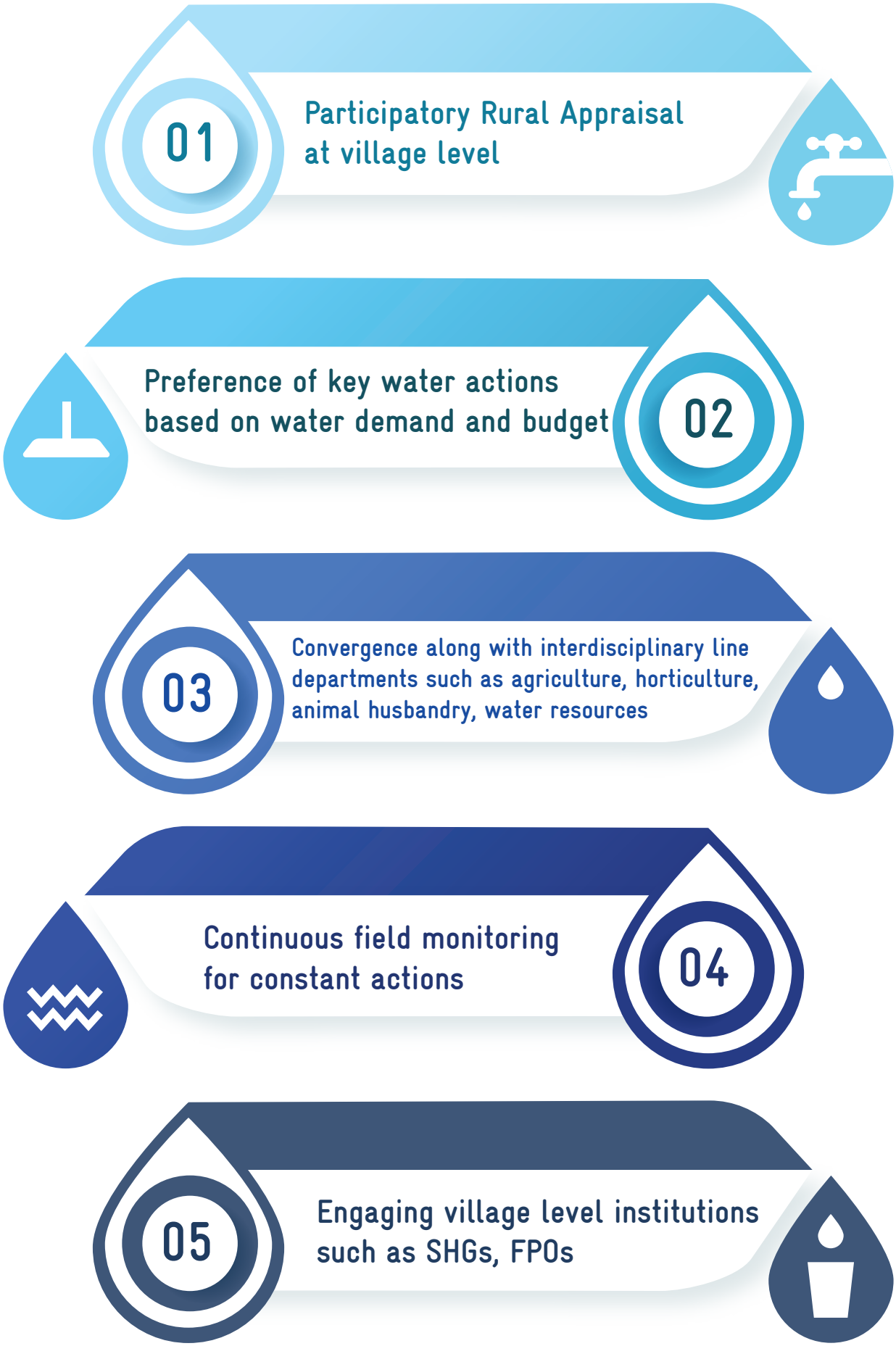
CONCLUSION

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

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



Recommendations towards stable development and its progressive outcome are:


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

ANNEXURES

ANNEXURE 1

TYPES OF GPs

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

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

ANNEXURE 3.1

KEY CWRM PARAMETER FROM SECONDARY SOURCES

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

Area under Current Fallow land	*https://censusindia.gov.in/2011census/dchb/DCHB.html*
Area under Unirrigated Land	
Area Irrigated by Source	
Soil Resources: Status of Available Nitrogen	*https://soilhealth.dac.gov.in/NewHomePage/NutriPage*
Very Low (VL)	
Low (L)	
Medium (M)	
High (H)	
Very High (VH)	
Status of Organic Carbon	
Very Low (VL)	
Low (L)	
Medium (M)	
High (H)	
Very High (VH)	
Status of Soil Micro Nutrients	
Sufficient	
Deficient	
Status of Physical condition of the soil	*https://soilhealth.dac.gov.in/NewHomePage/NutriPage*
Acidic Sulphate	
Strongly Acidic	
Highly Acidic	
Moderately Acidic	
Slightly Acidic	
Neutral	
Moderately Alkaline	
Strongly Alkaline	
Soil Texture	NRSC
% of Clay Soil	
% of Fine Soil	
% of Coarse loamy	
Soil Water Permeability	standard table
Soil moisture and ET	*https://indiawris.gov.in/wris/#/*
Volumetric Soil Moisture	
Livestock	*https://farmer.gov.in/livestockcensus.aspx*
Cattle Population	
Sheep Population	
Goat Population	
Poultry	

ANNEXURE 3.2

KEY CWRM PARAMETERS FROM PRIMARY SOURCES

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

ANNEXURE 3.3

KEY CWRM PARAMETER GENERATED -PRIMARY DATA

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

ANNEXURE 3.4

STANDARD NORMS FOR CALCULATING WATER DEMAND

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

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

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

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

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

ANNEXURE 3.5

STANDARD NORMS FOR GREY WATER GENERATION CALCULATION

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

ANNEXURE 3.6

WATER QUALITY STANDARDS AND FORMULA USED

RELATIVE WEIGHTS ASSIGNED FOR DIFFERENT WATER QUALITY PARAMETERS

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

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

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

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

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

The measurements a, b, c and d represent the relative concentration percentage of Na+, Mg2+, Cl^- and SO_4^{2-} assumed

ANNEXURE 3.7

GP WISE STATUS OF WATER RESOURCE AND ITS SUPPLY AND DEMAND

Gram Panchayat	Canal Network				Traditional water bodies			Irrigation Facilities (ha)		
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)	Tank Irrigation	Canal Irrigation	Open & Tube Well Irrigation
Selvanayagapuram	2,500	-	-	18,000	5	5	-	263.06	30.14	8.10
Kolundurai	-	1,000	-	3,500	3	8	-	189.38	-	56.72
Kumarakkurichi	-	1,500	450	3,250	3	5	-	116.69	-	3.97
Valandu	1,500	-	-	2,500	2	10	-	194.55	-	50.00
Alanganur	3,500	-	-	2,000	3	7	-	202.34	-	60.70
Anaiseri	5,000	-	-	6,000	5	6	-	60.70	4.04	121.40
Vilangalathur	1,500	300	-	3,000	4	8	-	161.80	3.23	48.50
Keeranoor	3,000	2,000	600	600	6	6	-	48.50	-	28.30
Kaakkor	5,000	1,000	-	5,000	2	40	-	202.30	8.09	97.20
Puliyangudi	3,000	3,000	-	10,000	2	10	-	850.00	50.00	100.00
Thiruvaragam	1,500	-	-	3,000	1	6	-	125.85	-	56.65
Siruthalai	5,000	-	-	6,000	6	6	-	202.34	-	40.46
Sellur	1,000	-	-	4,000	1	7	-	202.30	-	-
Vengalakurichi	8,000	3,000	-	11,000	3	5	-	270.00	-	1.21
Michaelpattinam	-	-	-	700	1	7	-	101.00	-	20.30
Mahindi	450	130	240	80	4	12	-	129.00	-	20.23
Kaelakulam	1,960	-	-	500	8	9	-	203.10	-	100.00
Sirugudi	5,000	3,000	-	5,000	4	3	-	109.20	-	20.23
Puludhikulam	2,000	-	-	2,000	2	6	-	60.70	-	2.02
Vilakanendal	2,000	-	-	2,500	1	5	-	31.16	2.02	4.04
Sambakulam	-	-	-	-	2	8	-	50.50	-	18.20
Sathanur	20,000	-	-	20,000	3	4	-	520.83	10.12	48.56
Keelathooval	6,000	2,000	2,000	7,000	4	12	-	40.47	-	6.07

Gram Panchayat	Canal Network				Traditional water bodies			Irrigation Facilities (ha)		
	Length of Main Canal (m)	Length of Minor Canal (m)	Length of Distributaries (m)	Water Courses (Field Channels) (m)	Number of Tanks (PWD & Union) (No.)	Number of Ooranis (No.)	Other Surface Water Bodies (No.)	Tank Irrigation	Canal Irrigation	Open & Tube Well Irrigation
Manaloor	4,000	-	-	2,500	2	7	-	82.00	-	101.71
Melakanniser	4,000	3,000	-	10,000	6	6	-	16.18	-	48.00
Nallur	150	100	50	200	3	2	-	12.10	-	1.21
Melakodumalur	2,500	3,000	-	16,000	2	5	-	204.21	-	30.44
Nallukuruchi	4,000	2,000	-	5,000	4	10	-	60.70	-	10.11
Vikiramapandiapuram	8,000	-	-	8,000	8	15	-	242.81	-	101.17
Athikulam	8,300	-	-	3,200	7	8	-	157.43	-	27.89
Keelakanchirankulam	2,500	-	-	7,500	1	5	-	242.81	-	68.00
Athanakurichi	500	-	-	1,200	6	5	-	283.10	40.40	20.23
Pirabakkallur	4,000	-	-	6,000	3	9	-	242.81	-	40.46
Posukudi	7,000	-	-	8,000	5	6	-	5,058.00	-	12.14
Keelakodumalur	10,000	-	-	7,000	9	8	-	12.14	2.60	6.07
S.R.N Palangulam	3,000	-	-	1,500	1	4	-	92.00	-	24.85
Kathankulam	2,500	-	-	3,000	2	5	-	41.66	-	12.30
Pooseri	2,400	3,200	-	3,000	3	7	-	28.98	-	9.80
Ponnakkaneri	5,000	500	-	3,000	5	7	-	2,023.00	-	12.14
Ulaiyur	-	-	-	5,000	3	6	-	121.40	20.23	24.28
Karumal	5,000	2,000	-	5,000	2	4	-	80.93	40.40	12.14
Arapothu	8,000	-	-	6,000	7	9	-	25.31	6.07	25.31
Sembongudi	1,000	-	-	4,000	2	3	-	101.70	-	-
Periya ilai	1,000	-	-	3,600	2	2	-	116.40	-	101.70
Athankothankudi	6,000	-	-	8,000	6	5	-	72.50	-	7.79
Theriruveli	10,000	-	-	6,000	6	19	-	255.71	958.29	40.40

Gram Panchayat	Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	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.)
Selvanayagapuram	131.10	-	95.40	7,605.29	7	11
Kolundurai	33.50	17.00	110.90	3,163.88	5	5
Kumarakkurichi	24.40	3.40	55.60	7,850.75	8	5
Valandu	36.70	-	128.60	2,837.93	6	8
Alanganur	29.90	12.40	82.20	2,663.63	2	5
Anaiseri	13.10	12.70	23.90	1,466.40	2	6
Vilangalathur	50.80	30.00	106.40	547.01	1	9
Keeranoor	13.10	12.70	23.90	-	-	7
Kaakkor	78.50	13.10	70.10	16,153.99	8	8
Puliyangudi	32.90	4.00	80.20	2,884.35	2	7
Thiruvaragam	17.00	2.40	50.40	-	-	5
Siruthalai	28.10	10.70	80.20	149.16	1	8
Sellur	35.50	16.40	107.20	382.46	1	8
Vengalakurichi	50.40	5.60	109.00	5,914.74	2	8
Michaelpattinam	6.50	0.20	12.60	1,573.22	2	3
Mahindi	40.90	2.00	84.80	5,227.50	4	8
Kaelakulam	62.50	25.50	87.70	4,434.39	4	7
Sirugudi	25.10	3.80	29.60	-	-	4
Puludhikulam	11.20	0.30	39.30	804.21	1	5
Vilakanendal	45.70	6.60	53.30	6,163.38	6	5
Sambakulam	26.50	1.90	75.00	195.09	1	6
Sathanur	18.40	0.30	64.90	575.35	1	5
Keelathooval	36.60	1.50	106.50	5,219.35	5	11
Manaloor	30.30	2.40	79.00	5,093.32	5	8
Melakanniser	29.90	1.00	78.70	1,602.29	2	5
Nallur	17.00	-	44.90	383.85	1	6
Melakodumalur	64.00	-	57.10	986.01	2	8

Gram Panchayat	Catchment Area wise Available Runoff (ha.m)			Watershed and Drainage Networks		
	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.)
Nallukuruchi	86.10	7.60	124.30	5,402.72	7	12
Vikiramapandiapuram	48.40	1.10	72.40	920.35	2	10
Athikulam	26.90	1.40	49.40	-	-	5
Keelakanchirankulam	12.40	0.60	22.80	2,154.78	2	3
Athanakurichi	25.50	9.30	70.00	864.66	2	6
Pirabakkallur	27.50	16.70	71.60	3,227.57	2	4
Posukudi	32.00	5.00	91.60	5,007.60	5	6
Keelakodumalur	45.30	2.60	83.40	-	-	5
S.R.N Palangulam	18.70	0.20	53.20	5,125.80	4	5
Kathankulam	8.10	12.60	14.70	434.87	2	5
Pooseri	29.50	9.70	111.30	9,523.36	6	7
Ponnakkaneri	27.80	0.50	84.10	6,030.65	7	8
Ulaiyur	23.90	6.00	90.40	4,251.96	2	5
Karumal	33.10	24.50	37.70	5,639.78	5	5
Arapothu	27.70	7.60	51.10	3,185.23	7	9
Sembongudi	9.50	2.60	36.30	-	-	5
Periya ilai	12.50	6.90	15.10	2,075.46	5	3
Athankothankudi	15.60	3.10	25.60	7,682.02	5	6
Theriruveli	62.40	22.30	123.20	11,191.94	6	7

Gram Panchayat	Water Demand								
	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)	GW Utilization for Drinking (%)	GW Utilization for Livestock (%)	GW Utilization for Agriculture. (%)	SW Utilization for Drinking (%)	SW Utilization for Livestock (%)	SW Utilization for Agriculture (%)
Selvanayagapuram	7	1	147	100	82	3	-	18	97
Kolundurai	6	1	667	100	28	23	-	72	77
Kumarakkurichi	4	1	324	100	56	3	-	44	97
Valandu	6	0	710	100	57	20	-	43	80
Alanganur	5	2	597	100	18	23	-	82	77
Anaiseri	7	1	782	97	26	65	3	74	35
Vilangalathur	11	1	795	98	78	23	2	22	77
Keeranoor	7	2	643	100	29	37	-	71	63
Kaakkor	11	1	461	99	36	32	1	64	68
Puliyangudi	4	1	477	86	62	10	14	38	90
Thiruvaragam	8	0	587	100	37	31	-	63	69
Siruthalai	9	1	587	100	22	17	-	78	83
Sellur	9	1	849	100	40	-	-	60	100
Vengalakurichi	9	1	737	88	42	-	12	58	100
Michaelpattinam	9	0	737	95	12	17	5	88	83
Mahindi	9	2	737	98	14	14	2	86	86
Kaelakulam	10	0	568	100	41	33	-	59	67
Sirugudi	5	0	568	100	47	16	-	53	84
Puludhikulam	11	0	568	75	52	3	25	48	97
Vilakanendal	5	0	400	100	48	11	-	52	89
Sambakulam	5	0	594	94	49	26	6	51	74
Sathanur	5	0	594	84	52	8	16	48	92
Keelathooval	3	1	946	98	37	13	2	63	87
Manaloor	6	1	600	100	50	55	-	50	45
Melakanniser	6	1	600	100	46	75	-	54	25
Nallur	3	0	427	94	69	9	6	31	91

Gram Panchayat	Water Demand								
	For Humans (ha.m)	For Livestock (ha.m)	For Agriculture (ha.m)	GW Utilization for Drinking (%)	GW Utilization for Livestock (%)	GW Utilization for Agriculture. (%)	SW Utilization for Drinking (%)	SW Utilization for Livestock (%)	SW Utilization for Agriculture (%)
Melakodumalur	4	1	637	98	54	13	2	46	87
Nallukuruchi	8	1	485	79	29	14	21	71	86
Vikiramapandiapuram	9	1	485	97	29	29	3	71	71
Athikulam	11	1	678	86	50	15	14	50	85
Keelakanchirankulam	11	0	678	91	49	22	9	51	78
Athanakurichi	6	0	1,093	96	44	6	4	56	94
Pirabakkallur	8	1	737	50	37	14	50	63	86
Posukudi	6	0	1,093	90	66	19	10	34	81
Keelakodumalur	8	1	289	96	30	29	4	70	71
S.R.N Palangulam	9	0	318	91	24	21	9	76	79
Kathankulam	7	0	861	47	12	23	53	88	77
Pooseri	7	27	461	96	1	25	4	99	75
Ponnakkaneri	7	1	914	98	82	38	2	18	62
Ulaiyur	7	1	914	95	46	15	5	54	85
Karumal	4	1	681	88	26	9	12	74	91
Arapothu	4	0	681	83	68	45	17	32	55
Sembongudi	7	0	764	83	43	-	17	57	100
Periya ilai	10	0	1,097	82	73	47	18	27	53
Athankothankudi	10	0	1,097	96	73	10	4	27	90
Theriruveli	13	2	736	99	22	3	1	78	97

ANNEXURE 3.8

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

GP	Locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Athankotankudi	Athankotankudi	E 78° 37' 51.211"	N 9° 18' 15.926"	Bore well	7.58	0	3,684	2,294	412
Kakkoor	Kakkoor	E 78° 34' 13.926"	N 9° 20' 54.812"	Bore well	6.95	4	17,190	10,840	305
Keelakodumalur	Sanmuganathapuram	E 78° 29' 26.401"	N 9° 28' 27.109"	Bore well	7.84	0	697	415	463
Keelathooval	KeelanThooval	E 78° 32' 44.927"	N 9° 25' 1.452"	Bore well	7.51	0	7,480	4,620	404
Mahindi	Mahindi	E 78° 34' 30.796"	N 9° 24' 57.006"	Bore well	7.51	0	693	405	404
Melakannicheri	Melakannicherry	E 78° 27' 38.916"	N 9° 24' 18.828"	Bore well	7.45	0	2,822	1,800	396
Muthukulathur	Muthukulathur	E 78° 30' 59.123"	N 9° 21' 7.24"	Bore well	7.32	0	8,030	5,010	358
Muthukulathur	Muthukulathur outer	E 78° 30' 37.998"	N 9° 20' 41.42"	Bore well	7.38	0	7,270	4,450	379
Nallukurichi	Near Sanmuganathapuram	E 78° 30' 9.702"	N 9° 29' 12.494"	Bore well	7.24	0	695	417	342
Nallur	Nalloor	E 78° 28' 31.076"	N 9° 24' 6.754"	Bore well	7.13	0	7,260	4,520	321
Ponnakkaneri	Thaliyarenthal	E 78° 40' 42.64"	N 9° 19' 38.014"	Bore well	7.78	0	8,140	5,130	451
Pooseri	Kadampodai	E 78° 40' 8.332"	N 9° 18' 45.097"	Bore well	7.47	0	18,720	10,350	397
Pooseri	Pooseri	E 78° 38' 25.386"	N 9° 18' 19.771"	Bore well	7.74	0	3,933	2,464	443
Posukkudi	Thanjakur	E 78° 34' 37.859"	N 9° 22' 6.535"	Bore well	7.38	0	13,150	8,370	378
Puliyangudi	Puliyangudi	E 78° 34' 23.707"	N 9° 21' 43.358"	Bore well	6.77	0	13,210	7,600	289
S R N Palangulam	Sadayaneri	E 78° 33' 58.205"	N 9° 18' 23.706"	Open well	7.52	4	22,656	14,200	405
Sellur	Muthuramalingapattinam	E 78° 35' 10.45"	N 9° 27' 5.411"	Bore well	6.93	4	23,100	13,180	303
Sellur	Vikrapandipuram	E 78° 36' 1.174"	N 9° 26' 14.658"	Bore well	7.53	0	9,080	5,740	407
Siruthalai	Siruthalai	E 78° 36' 26.046"	N 9° 25' 54.314"	Bore well	7.29	1	8,060	5,020	350
Theriruveli	Periyakaiyagm	E 78° 37' 11.33"	N 9° 20' 56.994"	Bore well	7.1	0	4,810	2,930	316
Tiruvarangam	Tiruvarangam	E 78° 36' 59.645"	N 9° 25' 24.733"	Bore well	7.23	0	8,370	5,180	338
Ulaiyur	Kodarendal	E 78° 37' 47.608"	N 9° 22' 25.91"	Bore well	7.13	0	5,910	3,850	320
Ulaiyur	Nediamanickam	E 78° 39' 16.859"	N 9° 22' 22.958"	Bore well	7.28	0	8,310	5,260	349
Ulaiyur	North Ulaiyur	E 78° 38' 29.778"	N 9° 22' 58.224"	Bore well	7.55	0	5,060	3,120	408
Valanadu	Valanadu	E 78° 39' 53.06"	N 9° 21' 18.943"	Bore well	7.3	1	11,350	7,160	351

GP	Locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Vikkiramapandiyapuram	MerkuKottakudi	E 78° 28' 52.81"	N 9° 27' 7.261"	Bore well	6.94	3	9,800	6,190	304
Vikkiramapandiyapuram	Near Perungarunai	E 78° 28' 53.034"	N 9° 27' 17.191"	Bore well	7.22	0	5,582	3,520	344
Vikkiramapandiyapuram	Perungarunai	E 78° 28' 57.731"	N 9° 27' 18.122"	Bore well	7.29	0	7,930	4,850	350
Vilangalathur	Vilangalathur	E 78° 32' 25.865"	N 9° 23' 41.744"	Bore well	7.43	0	7,150	4,480	393
Vilankulathur	Vennervaikal	E 78° 31' 49.854"	N 9° 22' 2.212"	Bore well	7.31	2	17,840	10,830	356

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
Athankotankudi	106	295	439	201	112	288	14	28	837	41	217.6	0.48
Kakkoor	63	228	2,049	937	525	1,200	18	16	5,574	15	1029.1	2.60
Keelakodumalur	116	325	83	38	21	67	23	8	76	6	52.4	0.07
Keelathooval	100	274	892	408	228	886	3	30	2,152	15	460.3	1.19
Mahindi	87	295	83	38	21	96	14	22	127	47	60.7	0.13
Melakannicheri	95	287	387	164	92	70	4	20	602	42	162.1	0.31
Muthukulathur	67	263	957	438	245	1,376	17	39	2,149	32	517.1	1.36
Muthukulathur	97	246	867	396	222	893	12	43	1,891	35	440.8	1.12
Nallukurichi	85	222	380	280	67	62	21	24	140	18	85.1	0.13
Nallur	36	259	865	396	222	826	10	31	2,250	18	457.7	1.21
Ponnakkaneri	107	325	970	444	248	495	8	16	2,147	21	459.9	1.04
Pooseri	98	265	2,232	1,020	571	1,205	18	11	4,799	47	986.7	2.32
Pooseri	105	327	469	214	120	282	10	26	859	51	229.3	0.49
Posukkudi	97	246	1,568	717	401	1,334	12	26	3,961	20	803	2.04
Puliyangudi	69	188	1,575	720	403	837	17	21	3,350	20	703.3	1.64
S R N Palangulam	97	293	3,045	1,671	682	127	13	42	3,954	27	1066.3	1.74
Sellur	39	227	2,754	1,259	705	2,336	24	15	3,715	28	1130.8	2.30
Sellur	99	293	450	160	45	1,438	14	17	1,729	8	442.1	1.14
Siruthalai	87	228	961	439	246	1,083	14	12	1,844	2	469.6	1.11
Theriruveli	95	187	270	120	112	618	12	36	1,112	5	263.4	0.70
Tiruvarangam	95	220	998	456	255	934	19	8	1,726	13	463.1	1.01
Ulaiyur	36	258	705	322	180	653	32	14	1,427	3	350.3	0.80
Ulaiyur	97	227	991	453	254	827	12	42	2,447	1	504.9	1.31
Ulaiyur	99	295	603	276	154	611	11	23	1,905	47	354.7	0.98
Valanadu	66	258	1,353	619	346	1,226	18	31	3,615	10	709.7	1.87
Vikkiramapandiyapuram	69	198	1,168	534	299	1,537	28	17	2,246	25	591.6	1.42
Vikkiramapandiyapuram	86	212	894	356	232	861	6	22	1,247	13	356.8	0.83
Vikkiramapandiyapuram	96	228	945	432	242	1,023	22	13	1,854	21	463.9	1.09
Vilangalathur	141	237	852	390	218	856	21	31	2,348	16	464.2	1.25
Vilankulathur	62	261	310	200	90	2,250	19	45	4,690	88	896	2.57

ANNEXURE 3.9

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

GP	Locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Athankotankudi	Athankotankudi	E 78° 37' 51.211"	N 9° 18' 15.926"	Bore well	6.94	1	8,800	5,456	694
Kakkoor	Kakkoor	E 78° 34' 13.926"	N 9° 20' 54.812"	Bore well	6.45	4	17,670	10,955	829
Keelakodumalur	Sanmuganathapuram	E 78° 29' 26.401"	N 9° 28' 27.109"	Bore well	7.24	0	777	482	88
Keelathooval	KeelanThooval	E 78° 32' 44.927"	N 9° 25' 1.452"	Bore well	6.54	1	10,720	6,646	748
Mahindi	Mahindi	E 78° 34' 30.796"	N 9° 24' 57.006"	Bore well	6.73	0	1,214	753	201
Melakannicheri	Melakannicherry	E 78° 27' 38.916"	N 9° 24' 18.828"	Bore well	7.2	0	5,660	3,509	393
Muthukulathur	Muthukulathur	E 78° 30' 59.123"	N 9° 21' 7.24"	Bore well	6.75	1	9,050	5,611	528
Muthukulathur	Muthukulathur outer	E 78° 30' 37.998"	N 9° 20' 41.42"	Bore well	7.06	0	6,310	3,912	402
Nallukurichi	Near Sanmuganathapuram	E 78° 30' 9.702"	N 9° 29' 12.494"	Bore well	7.34	0	827	513	101
Nallur	Nalloor	E 78° 28' 31.076"	N 9° 24' 6.754"	Bore well	6.7	0	10,460	6,485	704
Ponnakkaneri	Thaliyarenthal	E 78° 40' 42.64"	N 9° 19' 38.014"	Bore well	7.02	0	8,450	5,239	997
Pooseri	Kadampodai	E 78° 40' 8.332"	N 9° 18' 45.097"	Bore well	6.92	0	974	604	255
Pooseri	Pooseri	E 78° 38' 25.386"	N 9° 18' 19.771"	Bore well	7.76	0	1,074	666	308
Posukkudi	Thanjakur	E 78° 34' 37.859"	N 9° 22' 6.535"	Bore well	6.46	2	12,630	7,831	696
Puliyangudi	Puliyangudi	E 78° 34' 23.707"	N 9° 21' 43.358"	Bore well	6.52	1	12,180	7,552	786
S R N Palangulam	Sadayaneri	E 78° 33' 58.205"	N 9° 18' 23.706"	Open well	7.25	2	6,820	4,228	597
Sellur	Muthuramalingapattinam	E 78° 35' 10.45"	N 9° 27' 5.411"	Bore well	7.62	0	391	242	93
Sellur	Vikrapandipuram	E 78° 36' 1.174"	N 9° 26' 14.658"	Bore well	6.91	0	2,541	1,575	291
Siruthalai	Siruthalai	E 78° 36' 26.046"	N 9° 25' 54.314"	Bore well	6.77	0	2,485	1,541	266
Theriruveli	Periyakaiyagm	E 78° 37' 11.33"	N 9° 20' 56.994"	Bore well	6.94	0	8,450	5,239	733
Tiruvarangam	Tiruvarangam	E 78° 36' 59.645"	N 9° 25' 24.733"	Bore well	7.01	0	2,432	1,508	241
Ulaiyur	Kodarendal	E 78° 37' 47.608"	N 9° 22' 25.91"	Bore well	6.95	0	5,432	3,368	504
Ulaiyur	Nediamanickam	E 78° 39' 16.859"	N 9° 22' 22.958"	Bore well	7.01	0	12,200	7,564	722
Ulaiyur	North Ulaiyur	E 78° 38' 29.778"	N 9° 22' 58.224"	Bore well	6.67	0	6,140	3,807	411
Valanadu	Valanadu	E 78° 39' 53.06"	N 9° 21' 18.943"	Bore well	6.94	1	7,730	4,793	668

GP	Locations	Latitude	Longitude	Well type	pH	Salinity	EC (µS/cm)	TDS (ppm)	TA (mg/l)
Vikkiramapandiyapuram	MerkuKottakudi	E 78° 28' 52.81"	N 9° 27' 7.261"	Bore well	6.96	0	487	302	122
Vikkiramapandiyapuram	Near Perungarunai	E 78° 28' 53.034"	N 9° 27' 17.191"	Bore well	6.88	2	9,740	6,039	768
Vikkiramapandiyapuram	Perungarunai	E 78° 28' 57.731"	N 9° 27' 18.122"	Bore well	7.31	0	574	356	126
Vilangalathur	Vilangalathur	E 78° 32' 25.865"	N 9° 23' 41.744"	Bore well	6.84	0	8,160	5,059	595
Vilankulathur	Vennervaikal	E 78° 31' 49.854"	N 9° 22' 2.212"	Bore well	6.36	0	12,470	7,731	611

Gram Panchayat	CO_3 (mg/l)	HCO_3 (mg/l)	TH (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K(mg/l)	$S0_4$ (mg/l)	Cl (mg/l)	NO_3 (mg/l)	WQI	SMI
Athankotankudi	126	562	462	253	197	391	106	217	567	49	351.7	0.794
Kakkoor	153	663	1,316	682	612	764	81	238	2315	156	829.1	2.679
Keelakodumalur	11	67	54	30	13	18	5	27	54	4.23	41.5	0.121
Keelathooval	146	588	543	236	289	312	63	116	723	58.331	409	1.408
Mahindi	17	172	90	39	42	53	11.5	37	108.8	6.609	63.3	0.191
Melakannicheri	81	307	359	183	164	218	53.8	168	507.1	30.798	248.1	0.495
Muthukulathur	130	386	628	292	322	392	48	200	810.8	49.247	399.4	2.03
Muthukulathur	90	300	513	204	294	274	59.9	162	565.3	64	307.2	1.377
Nallukurichi	12	83	65	37	16	21	4	33	51	4.503	43.2	0.12
Nallur	134	556	494	278	197	335	76	192	637	56.918	387.3	1.357
Ponnakkaneri	121	865	599	316	271	367	98	237	553	59	366.8	1.026
Pooseri	34	189	94	32	49	37	6	57	96	13	59.7	1.335
Pooseri	66	227	99	53	37	49	13	79	87	23	66.3	0.405
Posukkudi	181	353	417	216	189	398	34	168	672	48	425	1.872
Puliyangudi	162	386	451	210	226	265	28	168	627	52	412.1	1.346
S R N Palangulam	198	385	419	226	182	347	52	143	605	57	299.6	0.582
Sellur	6	82	39	18	11	17	2	6	36	2.124	28.5	2.411
Sellur	56	207	161	72	86	105	16	98	197	9	117	1.664
Siruthalai	39	213	184	80	93	98	21	113	222.7	13.525	121.2	1.329
Theriruveli	179	538	524	226	288	392	67	186	720	92	378	1.193
Tiruvarangam	35	201	209	78	113	106	23.1	161.26	217.9	13.236	127.5	1.219
Ulaiyur	121	375	443	198	231	358	56	167	651	73	287.7	1.17
Ulaiyur	175	529	723	396	316	483	53	220	1176	96	515	1.669
Ulaiyur	73	324	381	198	167	238	54	137	453	33.414	256	0.993
Valanadu	162	482	564	236	315	372	61	197	794	76	370.2	1.865
Vikkiramapandiyapuram	11	103	52	26	13	19	4	18	43.6	2.651	32.1	1.609
Vikkiramapandiyapuram	140	612	615	276	326	405	58	243	872.7	53.004	422	1.573
Vikkiramapandiyapuram	12	112	55	29	12	21	5	26	51.4	6	36.4	1.095
Vilangalathur	117	469	468	216	236	283	59	99	632	44.402	330.8	1.31
Vilankulathur	128	469	553	240	301	426	73	182	239.9256	2.7248	414.9	2.617

ANNEXURE 3.10

GP WISE STATUS OF AGRICULTURE RESOURCE

Gram Panchayat	Land Resources (ha)								
	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source
Selvanayagapuram	591.00	-	-	-	-	88.78	106.48	381.80	263.06
Kolundurai	151.00	-	-	50.00	50.00	120.15	201.34	554.23	100.16
Kumarakkurichi	110.00	-	-	20.00	-	56.53	88.33	223.90	120.66
Valandu	165.34	-	-	-	0.14	2.85	123.80	816.66	188.60
Alanganur	134.68	-	-	72.80	-	149.42	132.02	344.44	97.88
Anaiseri	59.00	-	-	74.54	-	5.42	4.33	138.78	61.53
Vilangalathur	229.00	-	-	176.08	-	32.27	69.93	634.86	199.90
Keeranoor	59.00	-	-	74.54	-	5.42	4.33	138.78	61.53
Kaakkor	353.70	-	-	76.59	-	20.39	0.90	374.65	220.75
Puliyangudi	148.30	-	-	23.51	-	91.51	58.19	436.45	120.01
Thiruvaragam	76.61	-	-	14.10	-	1.32	161.10	228.27	53.28
Siruthalai	126.52	-	2.72	60.10	-	105.18	141.98	362.84	95.76
Sellur	160.19	-	13.28	83.00	-	118.91	128.58	557.76	138.27
Vengalakurichi	227.40	-	-	32.61	-	87.12	124.00	607.10	140.93
Michaelpattinam	29.10	-	-	1.40	-	16.42	15.68	62.45	16.02
Mahindi	184.30	-	-	12.02	-	88.89	79.97	475.38	101.81
Kaelakulam	281.83	-	-	100.96	48.50	166.23	12.61	380.40	213.03
Sirugudi	113.34	-	-	22.04	0.50	9.40	32.11	144.78	74.09
Puludhikulam	50.69	-	-	1.04	0.50	2.41	16.34	279.33	47.75
Vilakanendal	206.05	-	-	39.00	-	14.27	59.38	261.59	133.52
Sambakulam	119.50	-	-	11.25	-	15.72	14.35	550.66	79.20
Sathanur	82.89	-	-	1.04	0.50	2.88	27.15	462.93	78.11
Keelathooval	164.90	-	-	8.75	-	14.25	32.28	784.68	106.56
Manaloor	136.50	-	-	14.04	-	37.14	80.01	493.78	84.07

Gram Panchayat	Land Resources (ha)								
	Non-Agricultural Uses	Area under Barren & Un-cultivable Land	Area under Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Area Irrigated by Source
Melakanniser	135.00	-	-	6.02	-	53.80	48.00	459.34	131.73
Nallur	76.50	-	-	-	-	37.89	13.71	247.72	95.70
Melakodumalur	288.35	-	-	-	-	161.22	167.74	45.96	127.74
Nallukuruchi	388.15	-	-	44.40	-	224.36	328.83	286.92	254.27
Vikiramapandiapuram	218.00	-	-	6.66	-	14.13	94.90	350.89	177.01
Athikulam	121.29	-	-	4.91	3.12	10.52	2.37	274.01	147.88
Keelakanchirankulam	55.90	-	-	2.27	1.44	4.86	1.09	126.47	68.25
Athanakurichi	114.90	-	-	24.69	30.00	65.32	4.13	458.66	87.66
Pirabakkallur	123.90	-	-	28.21	70.00	97.75	5.64	458.71	68.57
Posukudi	144.20	-	-	29.40	-	54.66	4.00	611.50	135.97
Keelakodumalur	204.38	-	-	1.90	13.14	156.57	214.80	186.48	176.45
S.R.N Palangulam	84.51	-	-	-	0.93	204.40	26.45	145.95	91.89
Kathankulam	36.44	-	-	-	73.90	35.45	12.60	39.51	41.66
Pooseri	133.00	-	-	57.00	-	101.74	55.88	735.04	87.02
Ponnakkaneri	125.30	-	-	3.00	-	21.54	2.94	615.00	100.82
Ulaiyur	107.85	-	-	35.00	-	16.56	159.32	529.04	90.52
Karumal	-	149.40	-	-	144.00	30.00	10.26	22.36	269.23
Arapothu	100.00	24.90	-	20.66	24.00	50.08	33.73	216.81	149.35
Sembongudi	42.60	-	-	15.00	-	6.60	68.28	209.09	35.85
Periya ilai	-	56.40	-	-	40.60	10.00	-	6.23	116.40
Athankothankudi	70.50	-	-	5.75	12.50	-	7.79	145.50	72.50
Theriruveli	281.05	-	-	113.14	17.50	78.41	60.83	689.16	255.71

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Selvanayagapuram	591.00	-	840.12	3.40	168.19	132.19	1.52	145.84
Kolundurai	151.00	100.00	975.88	126.43	556.23	541.57	149.65	517.44
Kumarakkurichi	110.00	20.00	489.42	111.51	188.60	240.36	149.33	174.64
Valandu	165.34	0.14	1131.91	180.70	553.95	507.00	215.95	494.13
Alanganur	134.68	72.80	723.76	107.02	537.16	435.85	135.59	461.51
Anaiseri	59.00	74.54	210.06	234.20	430.36	664.56	351.30	430.36
Vilangalathur	229.00	176.08	936.96	174.76	532.41	707.16	262.13	532.41
Keeranoor	59.00	74.54	210.06	226.51	318.43	513.28	339.76	303.41
Kaakkor	353.70	76.59	616.69	201.94	241.25	305.56	252.05	208.50
Puliyangudi	148.30	23.51	706.16	110.80	333.00	390.00	165.48	311.05
Thiruvaragam	76.61	14.10	443.97	104.32	519.71	435.85	134.24	452.78
Siruthalai	126.52	62.82	705.76	104.32	519.71	435.85	134.24	452.78
Sellur	160.19	96.28	943.52	194.42	612.85	685.42	283.52	565.96
Vengalakurichi	227.40	32.61	959.15	155.72	592.22	547.15	220.56	516.19
Michaelpattinam	29.10	1.40	110.57	155.72	592.22	547.15	220.56	516.19
Mahindi	184.30	12.02	746.05	155.72	592.22	547.15	220.56	516.19
Kaelakulam	281.83	149.46	772.27	189.02	318.16	429.32	280.64	287.75
Sirugudi	113.34	22.54	260.38	189.02	318.16	429.32	280.64	287.75
Puludhikulam	50.69	1.54	345.83	189.02	318.16	429.32	280.64	287.75
Vilakanendal	206.05	39.00	468.76	175.97	150.36	298.21	259.33	140.26
Sambakulam	119.50	11.25	659.93	146.20	454.27	446.92	196.44	398.01
Sathanur	82.89	1.54	571.07	146.20	454.27	446.92	196.44	398.01
Keelathooval	164.90	8.75	937.77	100.60	834.67	838.07	150.89	794.93
Manaloor	136.50	14.04	695.00	98.41	452.32	550.73	147.62	452.32
Melakanniser	135.00	6.02	692.87	98.41	452.32	550.73	147.62	452.32

Gram Panchayat	Land under Catchment Area (ha)			Crop Details				
	Good Catchment	Average Catchment	Bad Catchment	Irrigated Area (ha)	Rainfed area (ha)	Paddy Cultivation (ha)	Crop Water Requirement - Irrigated condition (ha.m)	Crop Water Requirement - Rainfed condition (ha.m)
Nallur	76.50	-	395.02	159.74	204.65	325.60	237.46	189.96
Melakodumalur	288.35	-	502.66	229.85	332.00	490.32	324.70	312.70
Nallukuruchi	388.15	44.40	1094.38	156.45	305.91	378.36	214.35	270.20
Vikiramapandiapuram	218.00	6.66	636.93	156.45	305.91	378.36	214.35	270.20
Athikulam	121.29	8.03	434.78	266.84	303.74	526.11	389.54	288.40
Keelakanchirankulam	55.90	3.71	200.67	266.84	303.74	526.11	389.54	288.40
Athanakurichi	114.90	54.69	615.77	194.56	901.97	863.87	279.01	814.06
Pirabakkallur	123.90	98.21	630.67	102.17	601.40	676.05	143.65	593.64
Posukudi	144.20	29.40	806.13	194.56	901.97	863.87	279.01	814.06
Keelakodumalur	204.38	15.04	734.30	102.50	135.00	237.50	153.75	135.00
S.R.N Palangulam	84.51	0.93	468.69	96.51	173.02	269.52	144.76	173.02
Kathankulam	36.44	73.90	129.22	361.50	337.80	671.50	528.68	332.49
Pooseri	133.00	57.00	979.68	56.00	504.95	251.95	76.80	384.25
Ponnakkaneri	125.30	3.00	740.30	139.80	744.72	800.05	199.77	713.99
Ulaiyur	107.85	35.00	795.44	139.80	744.72	800.05	199.77	713.99
Karumal	149.40	144.00	331.85	136.60	534.80	538.05	194.82	485.77
Arapothu	124.90	44.66	449.97	136.60	534.80	538.05	194.82	485.77
Sembongudi	42.60	15.00	319.82	118.00	673.00	605.50	156.10	607.50
Periya ilai	56.40	40.60	132.63	288.70	694.61	945.70	404.07	692.44
Athankothankudi	70.50	18.25	225.79	288.70	694.61	945.70	404.07	692.44
Theriruveli	281.05	130.64	1084.11	215.50	476.20	546.60	313.89	421.80

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Organic Carbon (%)				
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High
Selvanayagapuram	53.97	46.03	-	-	-	36.51	63.49	-	-	-
Kolundurai	29.79	69.15	1.06	-	-	59.57	22.34	10.64	7.45	-
Kumarakkurichi	6.06	93.94	-	-	-	41.79	53.73	4.48	-	-
Valandu	77.78	22.22	-	-	-	9.26	81.48	9.26	-	-
Alanganur	30.99	69.01	-	-	-	52.11	47.89	-	-	-
Anaiseri	83.06	16.94	-	-	-	67.20	30.40	1.60	0.80	-
Vilangalathur	2.88	82.73	14.39	-	-	0.72	0.72	-	20.14	78.42
Keeranoor	36.51	63.49	-	-	-	0.79	-	-	-	99.21
Kaakkor	35.55	64.45	-	-	-	-	-	0.48	26.19	73.33
Puliyangudi	73.81	19.05	7.14	-	-	2.38	-	29.76	54.76	13.10
Thiruvaragam	16.48	79.12	3.30	-	1.10	1.10	-	-	6.59	92.31
Siruthalai	94.67	5.33	-	-	-	1.33	0.67	42.00	48.67	7.33
Sellur	94.67	5.33	-	-	-	1.33	0.67	42.00	48.67	7.33
Vengalakurichi	89.43	10.57	-	-	-	79.67	15.45	4.88	-	-
Michaelpattinam	89.43	10.57	-	-	-	79.67	15.45	4.88	-	-
Mahindi	96.49	3.51	-	-	-	35.09	63.16	1.75	-	-
Kaelakulam	1.72	21.55	49.14	27.59	-	0.87	-	-	47.83	51.30
Sirugudi	37.29	62.71	-	-	-	18.97	81.03	-	-	-
Puludhikulam	93.40	6.60	-	-	-	91.51	8.49	-	-	-
Vilakanendal	91.38	8.62	-	-	-	72.53	26.18	1.29	-	-
Sambakulam	96.49	3.51	-	-	-	35.09	63.16	1.75	-	-
Sathanur	91.00	9.00	-	-	-	-	-	8.00	59.00	33.00
Keelathooval	34.51	63.72	1.77	-	-	2.65	-	-	1.77	95.58
Manaloor	69.81	30.19	-	-	-	4.72	6.60	43.40	14.15	31.13
Melakanniser	95.37	3.70	0.93	-	-	70.37	29.63	-	-	-
Nallur	27.82	70.68	1.50	-	-	0.75	-	-	-	99.25
Melakodumalur	31.91	64.89	3.19	-	-	-	1.06	-	4.26	94.68
Nallukuruchi	97.00	3.00	-	-	-	59.00	31.00	10.00	-	-

Gram Panchayat	Soil Resources: Status of Available Nitrogen (%)					Status of Organic Carbon (%)				
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High
Vikiramapandiapuram	58.16	31.63	10.20	-	-	-	-	52.04	47.96	-
Athikulam	86.23	13.77	-	-	-	68.12	21.01	5.80	5.07	-
Keelakanchirankulam	86.23	13.77	-	-	-	68.61	20.44	5.84	5.11	-
Athanakurichi	86.78	13.22	-	-	-	51.15	43.68	1.15	-	4.02
Pirabakkallur	22.55	74.51	1.96	-	0.98	-	-	-	77.45	22.55
Posukudi	33.54	65.84	-	-	0.62	1.24	-	1.24	-	97.52
Keelakodumalur	12.73	87.27	-	-	-	1.82	-	-	-	98.18
S.R.N Palangulam	29.27	68.29	2.44	-	-	1.22	0.61	0.61	-	97.56
Kathankulam	50.60	49.40	-	-	-	46.39	53.61	-	-	-
Pooseri	34.44	65.56	-	-	-	-	-	-	2.22	97.78
Ponnakkaneri	58.72	41.28	-	-	-	89.91	5.50	-	4.59	-
Ulaiyur	40.96	56.02	2.41	0.60	-	-	0.60	-	20.48	78.92
Karumal	11.65	86.41	1.94	-	-	97.09	0.97	-	0.97	0.97
Arapothu	40.19	58.88	-	-	0.93	14.02	84.11	1.87	-	-
Sembongudi	79.07	20.93	-	-	-	42.29	53.14	2.29	2.29	-
Periya ilai	43.07	56.93	-	-	-	43.56	52.97	2.97	0.50	-
Athankothankudi	43.07	56.93	-	-	-	43.56	52.97	2.97	0.50	-
Theriruveli	29.27	68.29	2.44	-	-	1.22	0.61	0.61	-	97.56

Gram Panchayat	Status of Soil Micro Nutrients (%)		Status of Physical condition of the soil (%)							
	Sufficient	Deficient	Moderate-ly Acidic	Strongly Acidic	Highly Acidic	Moderate-ly Acidic	Slighly Acidic	Neutral	Moderate-ly Alkaline	Strongly Alkaline
Selvanayagapuram	51.00	49.00	-	-	2.38	27.78	5.56	3.97	52.38	7.94
Kolundurai	57.00	43.00	-	-	-	9.57	8.51	-	78.72	3.19
Kumarakkurichi	66.00	34.00	-	-	4.48	13.43	8.96	5.97	67.16	-
Valandu	60.00	40.00	-	-	-	27.78	37.04	1.85	33.33	-
Alanganur	62.00	38.00	-	-	-	11.27	12.68	2.82	73.24	-
Anaiseri	62.00	38.00	-	-	-	1.59	12.70	0.79	78.57	6.35
Vilangalathur	69.00	31.00	-	-	-	17.99	11.51	0.72	64.75	5.04
Keeranoor	51.00	49.00	-	-	2.38	27.78	5.56	3.97	52.38	7.94
Kaakkor	58.00	42.00	0.48	-	-	1.44	18.18	-	76.56	3.35
Puliyangudi	66.00	34.00	-	-	-	5.95	13.10	-	77.38	3.57
Thiruvaragam	80.00	20.00	-	-	-	2.20	10.99	-	51.65	35.16
Siruthalai	72.00	28.00	-	-	-	0.66	3.97	-	93.38	1.99
Sellur	72.00	28.00	-	-	-	0.66	3.97	-	93.38	1.99
Vengalakurichi	68.00	32.00	-	-	-	6.50	6.50	3.25	82.11	1.63
Michaelpattinam	68.00	32.00	-	-	-	6.50	6.50	3.25	82.11	1.63
Mahindi	68.00	32.00	-	-	-	-	4.39	-	95.61	-
Kaelakulam	54.00	46.00	-	-	-	3.45	6.90	-	86.21	3.45
Sirugudi	62.00	38.00	-	-	3.39	35.59	18.64	-	40.68	1.69
Puludhikulam	81.00	19.00	0.93	-	-	4.67	12.15	0.93	79.44	1.87
Vilakanendal	70.00	30.00	-	-	-	2.94	2.10	-	41.60	53.36
Sambakulam	68.00	32.00	-	-	-	-	4.39	-	95.61	-
Sathanur	81.00	19.00	0.99	-	-	4.95	12.87	0.99	78.22	1.98
Keelathooval	68.00	32.00	-	-	-	-	4.42	-	95.58	-
Manaloor	54.00	46.00	-	-	-	-	0.93	-	97.20	1.87
Melakanniser	55.00	45.00	-	-	-	-	0.92	-	97.25	1.83
Nallur	69.00	31.00	-	-	-	-	-	-	73.88	26.12
Melakodumalur	73.00	27.00	-	-	-	7.45	5.32	-	65.96	21.28

Gram Panchayat	Status of Soil Micro Nutrients (%)		Status of Physical condition of the soil (%)							
	Sufficient	Deficient	Moderate-ly Acidic	Strongly Acidic	Highly Acidic	Moderate-ly Acidic	Slighly Acidic	Neutral	Moderate-ly Alkaline	Strongly Alkaline
Nallukuruchi	70.00	30.00	-	-	-	29.00	27.00	-	44.00	-
Vikiramapandiapuram	70.00	30.00	-	-	-	29.59	27.55	-	42.86	-
Athikulam	59.00	41.00	-	-	0.72	3.62	3.62	2.90	71.01	18.12
Keelakanchirankulam	59.00	41.00	-	-	0.72	3.62	3.62	2.90	71.01	18.12
Athanakurichi	75.00	25.00	-	-	-	21.39	8.09	-	64.74	5.78
Pirabakkallur	74.00	26.00	-	-	-	36.63	13.86	-	49.50	-
Posukudi	58.00	42.00	-	-	4.97	39.13	19.25	-	36.65	-
Keelakodumalur	61.00	39.00	-	-	3.64	38.18	20.00	-	38.18	-
S.R.N Palangulam	50.00	50.00	-	-	3.05	40.24	29.27	-	27.44	-
Kathankulam	75.00	25.00	-	-	-	-	-	84.94	15.06	-
Pooseri	81.00	19.00	-	-	-	25.56	26.67	-	45.56	2.22
Ponnakkaneri	56.00	44.00	-	-	-	-	7.34	-	92.66	-
Ulaiyur	74.00	26.00	0.60	-	-	-	1.20	-	84.34	13.86
Karumal	64.00	36.00	-	-	3.88	19.42	15.53	-	60.19	0.97
Arapothu	64.00	36.00	-	-	3.74	18.69	14.95	-	61.68	0.93
Sembongudi	75.00	25.00	0.58	-	-	-	1.16	-	84.88	13.37
Periya ilai	62.00	38.00	0.50	-	-	11.39	15.84	-	72.28	-
Athankothankudi	62.00	38.00	0.50	-	-	11.39	15.84	-	72.28	-
Theriruveli	50.00	50.00	-	-	3.05	40.24	29.27	-	27.44	-

Gram Panchayat	Soil Texture (%)				Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)	
	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding
Selvanayagapuram	-	49.00	22.71	Moderate	17	142.82	336.62	43	57	97	3
Kolundurai	-	92.00	0.33	Moderate	17	182.90	367.69	50	50	77	23
Kumarakkurichi	-	97.00	-	Moderate	17	86.60	190.30	43	57	97	3
Valandu	-	81.00	10.37	Moderate	17	192.45	524.75	25	75	80	20
Alanganur	-	93.00	-	Moderate	17	135.42	268.89	11	89	77	23
Anaiseri	-	74.00	21.16	Moderate	17	48.38	143.47	47	52	35	65
Vilangalathur	-	42.00	45.72	High	17	189.22	527.66	12	87	77	23
Keeranoor	-	77.00	12.76	Moderate	17	48.38	143.47	38	62	63	37
Kaakkor	-	79.00	0.50	Moderate	17	117.86	350.78	17	83	68	32
Puliyangudi	-	94.00	-	Moderate	17	124.04	302.74	6	94	90	10
Thiruvaragam	-	96.00	-	Moderate	17	77.87	154.33	5	95	69	31
Siruthalai	-	94.00	-	Moderate	17	130.66	272.18	27	73	83	17
Sellur	-	96.00	-	Moderate	17	176.77	413.59	11	89	100	-
Vengalakurichi	-	76.00	17.67	Moderate	17	168.60	407.49	71	29	100	-
Michaelpattinam	-	96.00	-	Moderate	17	19.03	41.69	91	9	83	17
Mahindi	-	93.00	-	Moderate	17	128.87	307.57	59	41	86	14
Kaelakulam	-	62.00	27.79	Moderate	17	156.69	362.47	13	87	67	33
Sirugudi	-	55.00	33.86	Moderate	17	48.10	125.76	38	62	85	17
Puludhikulam	-	92.00	4.46	Moderate	17	59.05	171.28	89	11	97	3
Vilakanendal	-	47.00	30.99	Moderate	17	86.32	226.61	75	25	89	11
Sambakulam	-	94.00	0.13	Moderate	17	114.10	334.66	53	47	74	26
Sathanur	-	60.00	32.28	Moderate	17	97.34	282.97	55	45	91	9
Keelathooval	-	51.00	43.67	Moderate	17	160.91	469.79	75	25	87	13
Manaloor	-	70.00	21.22	Moderate	17	120.54	308.97	21	79	45	55
Melakanniser	-	61.00	32.15	Moderate	17	118.81	311.68	40	60	25	75

Gram Panchayat	Soil Texture (%)				Soil moisture and ET			Means of Water Extraction (%)		Irrigation Methods (%)	
	Clay soil	Fine Soil	Coarse loamy	Soil Water Permeability (Low, Moderate, high)	Volumetric Soil Moisture (%)	Estimated Soil Moisture (ha.m)	ET Losses (ha.m)	Gravity	Lifting	Wild Flooding	Control Flooding
Nallur	-	56.00	9.80	Moderate	17	67.15	179.27	33	67	91	9
Melakodumalur	-	25.00	45.69	High	17	85.45	90.67	37	63	87	13
Nallukuruchi	-	69.00	15.92	Moderate	17	193.59	305.68	60	40	86	14
Vikiramapandiapuram	-	58.00	29.59	Moderate	17	109.41	279.04	48	52	71	29
Athikulam	-	85.00	7.00	Moderate	17	75.28	222.79	39	61	85	15
Keelakanchirankulam	-	24.00	48.44	High	17	34.74	102.83	18	82	78	22
Athanakurichi	-	91.00	1.56	Moderate	17	113.98	298.07	74	26	94	6
Pirabakkallur	-	71.00	23.22	Moderate	17	123.91	289.97	18	82	92	8
Posukudi	-	91.00	-	Moderate	17	142.04	405.53	29	71	81	19
Keelakodumalur	-	46.00	41.45	Moderate	17	127.39	190.44	82	18	71	29
S.R.N Palangulam	-	89.00	-	Moderate	17	79.84	124.15	33	67	79	21
Kathankulam	-	90.00	-	Moderate	17	34.53	42.37	55	45	77	23
Pooseri	-	97.00	-	Moderate	17	176.24	458.87	18	82	75	25
Ponnakkaneri	-	92.00	2.68	Moderate	17	126.36	375.22	55	45	63	37
Ulaiyur	-	12.00	83.43	High	17	141.17	341.68	56	44	85	15
Karumal	-	92.00	-	Moderate	17	106.29	152.21	73	27	91	9
Arapothu	-	91.00	-	Moderate	17	88.32	201.92	22	78	55	45
Sembongudi	-	50.00	46.19	Moderate	17	56.92	135.69	100	-	100	-
Periya ilai	-	91.00	-	Moderate	17	39.04	64.01	5	95	53	47
Athankothankudi	-	93.00	-	Moderate	17	41.49	116.80	58	42	90	10
Theriruveli	-	83.00	8.00	Moderate	17	206.51	552.28	58	42	97	3

Gram Panchayat	Livestock (No.)			
	Cattle Population	Sheep Population	Goat Population	Poultry
Selvanayagapuram	142	-	295	-
Kolundurai	70	635	1,177	975
Kumarakkurichi	104	564	209	876
Valandu	70	481	39	47
Alanganur	99	3,277	1,072	2,094
Anaiseri	53	286	1,194	238
Vilangalathur	106	-	268	1,027
Keeranoor	136	1,951	1,285	1,984
Kaakkor	97	932	738	728
Puliyangudi	245	715	759	550
Thiruvaragam	22	217	141	314
Siruthalai	81	1,979	774	1,392
Sellur	102	728	741	835
Vengalakurichi	110	354	1,080	1,654
Michaelpattinam	10	652	109	166
Mahindi	67	3,274	698	883
Kaelakulam	36	143	371	395
Sirugudi	29	49	266	353
Puludhikulam	40	236	120	235
Vilakanendal	62	103	562	748
Sambakulam	60	188	418	278
Sathanur	66	393	197	389
Keelathooval	75	655	628	305
Manaloor	125	975	272	345
Melakanniser	145	1,052	557	894
Nallur	92	77	285	550
Melakodumalur	194	432	715	1,079
Nallukuruchi	93	577	1,654	789

Gram Panchayat	Livestock (No.)			
	Cattle Population	Sheep Population	Goat Population	Poultry
Vikiramapandiapuram	87	751	1,359	844
Athikulam	105	600	412	833
Keelakanchirankulam	48	277	190	384
Athanakurichi	59	464	263	439
Pirabakkallur	87	1,079	377	425
Posukudi	50	4	237	599
Keelakodumalur	45	139	922	310
S.R.N Palangulam	11	315	31	126
Kathankulam	7	433	67	64
Pooseri	59	-	348	268
Ponnakkaneri	165	94	251	153
Ulaiyur	89	638	402	175
Karumal	54	778	143	202
Arapothu	59	217	60	127
Sembongudi	39	316	192	83
Periya ilai	36	-	128	96
Athankothankudi	45	-	160	121
Theriruveli	110	800	3,195	202

ANNEXURE 3.11

GP WISE DEMOGRAPHIC AND SOCIO ECONOMIC STATUS

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)
Selvanayagapuram	1,431	1,314	1,275	2,589	7	-	7	630	51
Kolundurai	1,227	938	1,144	2,082	800	3	803	577	73
Kumarakkurichi	619	850	747	1,597	508	-	508	362	11
Valandu	1,297	1,034	1,070	2,104	317	-	317		548
Alanganur	1,001	932	891	1,823	1,194	-	1,194	408	172
Anaiseri	953	1,238	1,246	2,484	158	-	158	627	121
Vilangalathur	1,382	1,862	1,985	3,847	1,615	-	1,615	1,075	99
Keeranoor	967	1,238	1,246	2,484	158	-	158	992	213
Kaakkor	1,007	2,015	1,999	4,014	1,894	-	1,894	980	142
Puliyangudi	869	664	665	1,329	-	-	-	365	2
Thiruvaragam	537	1,649	1,392	3,041	608	-	608	661	73
Siruthalai	797	1,720	1,698	3,418	1,458	-	1,458	852	21
Sellur	1,189	1,720	1,698	3,418	1,458	-	1,458	852	21
Vengalakurichi	1,178	1,641	1,751	3,392	784	-	784	987	25
Michaelpattinam	130	1,641	1,751	3,392	784	-	784	987	25
Mahindi	892	1,641	1,751	3,392	784	-	784	987	25
Kaelakulam	1,331	1,837	1,788	3,625	1,287	-	1,287	849	81
Sirugudi	321	860	918	1,778	222	-	222	437	20
Puludhikulam	360	1,929	1,971	3,900	540	-	540	992	67
Vilakanendal	556	860	918	1,778	222	-	222	437	20
Sambakulam	750	1,003	947	1,950	134	1	135	495	38
Sathanur	694	1,003	947	1,950	134	1	135	495	38
Keelathooval	1,417	465	550	1,015	21	-	21	1,338	74
Manaloor	842	996	1,069	2,065	304	-	304	588	131

Gram Panchayat	Geographical Area (ha)	Male Population (No.)	Female Population (No.)	Total Population (No.)	SC Population (No.)	ST Population (No.)	Vulnerable popupation (No.)	Households (HH's) (No.)	Only one room HH's (SECC) (No.)
Melakanniser	652	996	1,069	2,065	304	-	304	588	131
Nallur	347	611	648	1,259	78	-	78	918	171
Melakodumalur	895	753	750	1,503	931	-	931	427	14
Nallukuruchi	1,417	1,451	1,338	2,789	329	-	329	615	97
Vikiramapandiapuram	633	1,628	1,526	3,154	329	-	329	721	97
Athikulam	789	1,939	1,923	3,862	1,538	-	1,538	907	363
Keelakanchirankulam	291	1,939	1,923	3,862	1,538	-	1,538	907	363
Athanakurichi	706	1,002	1,049	2,051	505	-	505	588	140
Pirabakkallur	828	1,391	1,572	2,963	1,006	-	1,006	799	46
Posukudi	929	1,002	1,049	2,051	505	-	505	588	140
Keelakodumalur	417	1,430	1,451	2,881	1,259	-	1,259	793	54
S.R.N Palangulam	515	1,520	1,613	3,133	1,811	-	1,811	773	20
Kathankulam	230	1,210	1,200	2,410	627	-	627	507	3
Pooseri	1,371	1,185	1,191	2,376	174	-	174	237	3
Ponnakkaneri	1,084	1,185	1,191	2,376	174	-	174	237	3
Ulaiyur	986	1,207	1,190	2,397	862	-	862	429	32
Karumal	708	692	690	1,382	700	-	700	429	32
Arapothu	616	692	690	1,382	700	-	700	429	32
Sembongudi	459	1,207	1,190	2,397	862	-	862	575	8
Periya ilai	221	1,909	1,884	3,793	2,267	-	2,267	1,017	143
Athankothankudi	680	1,909	1,884	3,793	2,267	-	2,267	1,017	143
Theriruveli	1,668	2,353	2,366	4,719	2,379	-	2,379	1,146	78

Gram Panchayat	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha.m)
Selvanayagapuram	15	40	6	766	686	2	600	-	5
Kolundurai	69	72	12	761	568	30	527	-	4
Kumarakkurichi	28	16	4	522	409	25	375	-	3
Valandu	157	52	13	877	567	47	530	250	4
Alanganur	35	131	32	796	689	85	460	540	3
Anaiseri	45	98	16	307	254	32	120	204	5
Vilangalathur	90	96	9	2,059	1,396	133	490	400	7
Keeranoor	91	176	18	732	625	9	290	290	5
Kaakkor	83	124	13	823	711	116	806	180	7
Puliyangudi	17	7	2	904	737	7	350	500	2
Thiruvaragam	43	64	10	640	417	260	547	160	6
Siruthalai	71	36	4	697	529	61	530	250	6
Sellur	71	36	4	858	723	273	600	310	6
Vengalakurichi	102	48	5	856	700	8	621	500	6
Michaelpattinam	102	48	5	430	318	20	100	180	6
Mahindi	102	48	5	911	827	122	394	240	6
Kaelakulam	63	76	9	1,008	765	14	110	50	7
Sirugudi	46	28	6	353	331	15	149	100	3
Puludhikulam	63	66	7	542	421	24	300	226	7
Vilakanendal	46	28	6	391	333	62	290	93	3
Sambakulam	32	36	7	902	698	16	400	182	4
Sathanur	32	36	7	707	491	55	495	1,005	4
Keelathooval	98	81	6	746	592	133	216	400	2
Manaloor	86	118	20	1,069	912	24	350	300	4
Melakanniser	86	118	20	523	455	58	442	205	4

Gram Panchayat	Female Headed HH's (SECC) (No.)	Vulnerable Households (SECC) (No.)	% of Vulnerable Households (%)	Registered MGNREGA Job cards (Persons)	Active person working in MGNREGA job Cards (Persons)	Drinking Water Sources (No.)	HH's have tap water connection for drinking water (No.)	HH's dependent on other sources for drinking water (No.)	Annual Greywater Generation (ha.m)
Nallur	68	140	15	388	313	16	102	160	2
Melakodumalur	35	20	5	1,152	864	133	216	400	3
Nallukuruchi	30	77	13	1,015	726	48	408	282	5
Vikiramapandiapuram	38	79	11	661	548	120	214	730	6
Athikulam	72	276	30	576	412	21	250	450	7
Keelakanchirankulam	72	276	30	445	324	35	140	200	7
Athanakurichi	65	118	20	792	598	82	220	270	4
Pirabakkallur	53	48	6	959	800	4	-	795	5
Posukudi	65	118	20	512	398	21	52	378	4
Keelakodumalur	64	57	7	1,042	821	53	160	400	5
S.R.N Palangulam	51	29	4	320	243	22	142	370	6
Kathankulam	29	11	2	278	232	30	135	50	4
Pooseri	31	11	5	878	707	54	670	570	4
Ponnakkaneri	31	11	5	867	731	118	650	600	4
Ulaiyur	23	29	7	626	484	39	400	280	4
Karumal	23	29	7	562	431	17	300	198	3
Arapothu	23	29	7	626	484	12	300	550	3
Sembongudi	49	20	4	352	270	12	292	550	4
Periya ilai	31	109	11	378	307	11	230	1,000	7
Athankothankudi	31	109	11	480	339	45	300	1,000	7
Theriruveli	80	79	7	2,134	1,488	302	1,200	950	9

ANNEXURE 4

IPCC VULNERABILITY ASSESSMENT METHODOLOGY

Normalization of Indicators:

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

- for indicators with positive relationship with vulnerability

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

- for indicators with negative relationship with vulnerability

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

Aggregation and categorization of Indicators

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

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

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

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

ANNEXURE 5.1

GP WISE WASCA PROPOSED TREATMENT AREA

Gram Panchayat	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Treatment Area Irrigated by Source
Selvanayagapuram	10.06	-	-	-	-	3.55	4.26	15.27	10.52
Kolundurai	2.57	-	-	42.50	42.50	7.21	12.08	33.25	6.01
Kumarakkurichi	1.87	-	-	17.00	-	2.26	3.53	8.96	4.83
Valandu	2.81	-	-	-	0.12	0.11	4.95	32.67	7.54
Alanganur	2.29	-	-	61.88	-	8.97	7.92	20.67	5.87
Anaiseri	1.00	-	-	63.36	-	0.87	0.69	22.20	9.84
Vilangalathur	3.90	-	-	149.66	-	2.90	6.29	57.14	17.99
Keeranoor	1.00	-	-	63.36	-	0.98	0.78	24.98	11.07
Kaakkor	6.02	-	-	65.10	-	2.65	0.12	48.70	28.70
Puliyangudi	2.52	-	-	19.98	-	1.83	1.16	8.73	2.40
Thiruvaragam	1.30	-	-	11.99	-	0.13	16.11	22.83	5.33
Siruthalai	2.15	-	2.31	51.09	-	4.21	5.68	14.51	3.83
Sellur	2.73	-	11.29	70.55	-	4.76	5.14	22.31	5.53
Vengalakurichi	3.87	-	-	27.72	-	4.36	6.20	30.36	7.05
Michaelpattinam	0.50	-	-	1.19	-	0.82	0.78	3.12	0.80
Mahindi	3.14	-	-	10.21	-	4.44	4.00	23.77	5.09
Kaelakulam	8.19	-	-	85.81	41.23	14.96	1.13	34.24	19.17
Sirugudi	8.30	-	-	18.73	0.43	0.56	1.93	8.69	4.45
Puludhikulam	0.86	-	-	0.88	0.43	0.17	1.14	19.55	3.34
Vilakanendal	15.55	-	-	33.15	-	0.86	3.56	15.70	8.01
Sambakulam	2.03	-	-	9.56	-	1.10	1.00	38.55	5.54
Sathanur	1.41	-	-	0.88	0.43	0.20	1.90	32.41	5.47
Keelathooval	2.81	-	-	7.44	-	0.86	1.94	47.08	6.39
Manaloor	2.32	-	-	11.93	-	7.43	16.00	98.76	16.81

Gram Panchayat	Non-Agricultural Uses	Barren & Un-cultivable Land	Permanent Pastures and Other Grazing Land	Land Under Miscellaneous Tree Criticalops etc.	Cultivable Waste Land	Fallows Land other than Current Fallows	Current Fallow land	Unirrigated Land	Treatment Area Irrigated by Source
Melakanniser	2.30	-	-	5.11	-	10.76	9.60	91.87	26.35
Nallur	1.30	-	-	-	-	5.68	2.06	37.16	14.35
Melakodumalur	40.37	-	-	-	-	8.06	8.39	2.30	6.39
Nallukuruchi	17.90	-	-	37.74	-	29.17	42.75	37.30	33.06
Vikiramapandiapuram	9.84	-	-	5.66	-	1.55	10.44	38.60	19.47
Athikulam	1.55	-	-	4.18	2.65	3.16	0.71	82.20	44.37
Keelakanchirankulam	0.70	-	-	1.93	1.22	1.46	0.33	37.94	20.48
Athanakurichi	1.96	-	-	20.99	25.50	13.06	0.83	91.73	17.53
Pirabakkallur	2.11	-	-	23.98	59.50	5.86	0.34	27.52	4.11
Posukudi	2.45	-	-	24.99	-	3.28	0.24	36.69	8.16
Keelakodumalur	2.49	-	-	1.62	11.17	10.96	15.04	13.05	12.35
S.R.N Palangulam	1.44	-	-	-	0.79	8.18	1.06	5.84	3.68
Kathankulam	0.62	-	-	-	62.82	1.42	0.50	1.58	1.67
Pooseri	2.26	-	-	48.45	-	5.09	2.79	36.75	4.35
Ponnakkaneri	2.13	-	-	2.55	-	1.08	0.15	30.75	5.04
Ulaiyur	1.84	-	-	29.75	-	1.16	11.15	37.03	6.34
Karumal	-	126.99	-	-	122.40	2.10	0.72	1.57	18.85
Arapothu	1.70	21.17	-	17.56	20.40	3.51	2.36	15.18	10.45
Sembongudi	0.73	-	-	12.75	-	0.26	2.73	8.36	1.43
Periya ilai	-	47.94	-	-	34.51	1.10	-	0.69	12.80
Athankothankudi	1.20	-	-	4.89	10.63	-	0.86	16.01	7.98
Theriruveli	4.78	-	-	96.17	14.88	5.49	4.26	48.24	17.90

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

ANNEXURE 5.2

GP WISE EXPECTED RUNOFF CONSERVATION AFTER WASCA TREATMENT

Key CWRM Parameter	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Selvanayagapuram	46.09	-	5.09
Kolundurai	17.94	14.86	6.83
Kumarakkurichi	8.44	2.97	2.28
Valandu	34.29	-	10.89
Alanganur	13.95	10.82	5.06
Anaiseri	7.16	11.08	3.92
Vilangalathur	34.02	26.17	9.83
Keeranoor	10.23	11.08	4.41
Kaakkor	59.92	11.38	9.35
Puliyangudi	26.89	3.49	1.65
Thiruvaragam	12.36	2.10	5.18
Siruthalai	24.50	9.34	3.29
Sellur	18.48	14.31	4.40
Vengalakurichi	26.98	4.85	5.59
Michaelpattinam	3.21	-	0.64
Mahindi	26.96	1.79	4.35
Kaelakulam	49.88	22.22	8.10
Sirugudi	2.25	3.35	1.82
Puludhikulam	3.56	0.23	2.82
Vilakanendal	14.40	5.80	3.28
Sambakulam	8.30	1.67	5.39
Sathanur	12.36	0.23	4.66
Keelathooval	34.18	1.30	6.56
Manaloor	24.48	2.09	16.20
Melakanniser	5.96	0.89	16.16
Nallur	7.42	-	6.91
Melakodumalur	26.10	-	2.93
Nallukuruchi	30.83	6.60	16.59
Vikiramapandiapuram	13.01	0.99	8.17
Athikulam	24.69	1.19	15.21
Keelakanchirankulam	10.32	0.55	7.02
Athanakurichi	15.66	8.13	14.36
Pirabakkallur	10.91	14.60	4.41
Posukudi	15.23	4.37	5.64
Keelakodumalur	33.83	2.24	5.99
S.R.N Palangulam	5.19	0.14	2.19
Kathankulam	4.98	10.99	0.60
Pooseri	21.36	8.47	5.71
Ponnakkaneri	18.94	0.45	4.32
Ulaiyur	9.27	5.20	6.49
Karumal	21.63	21.40	2.71
Arapothu	20.11	6.64	3.67

Key CWRM Parameter	Good Catchment Area	Average Catchment Area	Bad Catchment Area
Sembongudi	4.50	2.23	1.49
Periya ilai	6.52	6.03	1.70
Athankothankudi	7.63	2.71	2.90
Theriruveli	56.32	19.42	8.85

ANNEXURE 5.3

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

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	Plants	Area	No.	Length	No.
Alanganur	1,834	2	24	1,045	4,180	2	49,504	62	521	2,085	2
Anaiseri	803	1	49	1,587	6,349	1	50,686	63	-	-	1
Arapothu	18,294	23	10	713	2,852	1	30,369	38	977	3,909	1
Athanakurichi	1,564	2	8	1,197	4,787	1	37,189	46	185	741	1
Athankothankudi	960	1	3	-	-	1	12,410	16	-	-	1
Athikulam	1,239	2	11	894	3,574	3	5,463	7	346	1,385	3
Kaakkor	4,816	6	39	1,279	5,115	2	52,081	65	-	-	2
Karumal	101,592	127	5	1,461	5,844	1	97,920	122	658	2,632	1
Kathankulam	496	1	5	403	1,612	1	50,255	63	54	217	1
Keelakanchirankulam	562	1	27	220	881	1	2,521	3	937	3,747	1
Keelakodumalur	1,989	2	2	625	2,500	1	10,229	13	384	1,534	1
Keelakulam	6,555	8	40	1,070	4,280	1	101,631	127	1,465	5,858	1
Keelathooval	2,245	3	2	1,165	4,658	2	5,950	7	726	2,902	2
Keeranoor	803	1	11	1,893	7,571	3	50,686	63	-	-	3
Mahindi	2,509	3	8	535	2,141	2	8,170	10	1,865	7,458	2
Manaloor	1,859	2	41	1,661	6,644	3	9,544	12	1,201	4,805	3
Melakanniser	1,838	2	19	520	2,079	4	4,090	5	347	1,389	4
Melakodumalur	32,300	40	82	1,163	4,650	1	-	-	685	2,738	1
Michaelpattinam	396	1	8	488	1,953	-	954	1	591	2,365	-
Nallukuruchi	14,323	18	4	2,030	8,121	2	30,192	38	2,632	10,527	2
Nallur	1,042	1	-	949	3,796	2	-	-	549	2,195	2
Periya Ilai	38,352	48	41	641	2,563	1	27,608	35	325	1,301	1
Pirabakkallur	1,687	2	16	2,279	9,114	2	66,783	83	1,201	4,803	2
Ponnakkaneri	1,706	2	5	1,241	4,963	4	2,040	3	1,814	7,255	4
Pooseri	1,811	2	4	1,191	4,764	1	38,760	48	853	3,412	1
Posukudi	1,963	2	5	1,712	6,848	1	19,992	25	526	2,105	1

Gram Panchayat	Aff		ARS	AVP		Az	BP		CBP		CS
	No.	Area	No.	No.	Length	No.	Plants	Area	No.	Length	No.
Puliyangudi	2,019	3	40	843	3,371	6	15,987	20	-	-	6
Puludhikulam	690	1	1	851	3,405	1	1,048	1	203	813	1
S.R.N.Palangulam	1,151	1	10	804	3,217	1	633	1	907	3,628	1
Sambakulam	1,627	2	7	934	3,737	2	7,650	10	848	3,390	2
Sathanur	1,129	1	19	853	3,413	2	1,048	1	944	3,775	2
Sellur	2,181	3	-	1,312	5,249	3	56,440	82	991	3,963	3
Sembongudi	580	1	-	995	3,981	1	10,200	13	173	690	1
Sirugudi	6,638	8	8	1,046	4,184	1	15,328	19	493	1,973	1
Siruthalai	1,723	2	16	686	2,743	2	40,868	53	277	1,106	2
Theriruveli	3,827	5	16	5,287	21,147	3	88,835	111	1,723	6,893	3
Thiruvaragam	1,043	1	23	576	2,303	1	9,588	12	-	-	1
Ulaiyur	1,468	2	10	-	-	2	23,800	30	-	-	2
Vengalakurichi	3,096	4	-	1,576	6,302	3	22,176	28	1,456	5,822	3
Vikiramapandiapuram	7,869	10	40	2,060	8,239	2	4,529	6	539	2,154	2
Vilakanendal	12,437	16	2	1,387	5,548	2	26,520	33	2,417	9,667	2
Vilangalathur	3,118	4	19	2,814	11,256	3	119,731	150	-	-	3

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI	
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area
Alanganur	2	15	43	15	458	2	-	-	9	22	17	43
Anaiseri	1	10	34	10	201	1	-	-	7	17	13	34
Arapothu	1	8	32	8	4,573	23	215	860	6	16	13	32
Athanakurichi	1	42	123	42	391	2	-	-	25	62	49	123
Athankothankudi	1	7	25	7	240	1	-	-	5	12	10	25
Athikulam	3	34	130	34	310	2	-	-	26	65	52	130
Kaakkor	2	21	80	21	1,204	6	597	2,386	16	40	32	80
Karumal	1	2	23	2	25,398	127	-	-	5	12	9	23
Kathankulam	1	1	5	1	124	1	-	-	1	3	2	5
Keelakanchirankulam	1	16	60	16	141	1	754	3,016	12	30	24	60
Keelakodumalur	1	16	51	16	497	2	-	-	10	26	21	51
Keelakulam	1	20	70	20	1,639	8	-	-	14	35	28	70
Keelathooval	2	20	56	20	561	3	-	-	11	28	23	56
Keeranoor	3	11	38	11	201	1	-	-	8	19	15	38
Mahindi	2	13	37	13	627	3	-	-	7	19	15	37
Manaloor	3	49	139	49	465	2	-	-	28	70	56	139
Melakanniser	4	45	139	45	460	2	-	-	28	69	55	139
Melakodumalur	1	7	25	7	8,075	40	1,094	4,375	5	13	10	25
Michaelpattinam	-	2	6	2	99	1	-	-	1	3	2	6
Nallukuruchi	2	44	142	44	3,581	18	1,053	4,210	28	71	57	142
Nallur	2	18	59	18	260	1	-	-	12	30	24	59
Periya Ilai	1	1	15	1	9,588	48	-	-	3	7	6	15
Pirabakkallur	2	13	38	13	422	2	754	3,016	8	19	15	38
Ponnakkaneri	4	13	37	13	427	2	169	677	7	19	15	37
Pooseri	1	18	49	18	453	2	-	-	10	24	20	49
Posukudi	1	16	48	16	491	2	-	-	10	24	19	48
Puliyangudi	6	5	14	5	505	3	-	-	3	7	6	14
Puludhikulam	1	8	24	8	173	1	-	-	5	12	10	24

Gram Panchayat	CT	Co		FP	CCBF		DLT		DLHAI		FBBTI	
	No.	No.	Area	No.	No.	Area	Plants	Length	No.	Area	No.	Area
S.R.N.Palangulam	1	6	19	6	288	1	735	2,941	4	9	7	19
Sambakulam	2	16	46	16	407	2	-	-	9	23	18	46
Sathanur	2	14	40	14	282	1	-	-	8	20	16	40
Sellur	3	13	38	13	545	3	-	-	8	19	15	38
Sembongudi	1	5	13	5	145	1	-	-	3	6	5	13
Sirugudi	1	4	16	4	1,660	8	-	-	3	8	6	16
Siruthalai	2	10	28	10	431	2	-	-	6	14	11	28
Theriruveli	3	23	76	23	957	5	1,111	4,445	15	38	30	76
Thiruvaragam	1	16	44	16	261	1	-	-	9	22	18	44
Ulaiyur	2	20	56	20	367	2	-	-	11	28	22	56
Vengalakurichi	3	16	48	16	774	4	-	-	10	24	19	48
Vikiramapandiapuram	2	20	70	20	1,967	10	153	611	14	35	28	70
Vilakanendal	2	8	28	8	3,109	16	662	2,647	6	14	11	28
Vilangalathur	3	27	84	27	780	4	-	-	17	42	34	84

Gram Panchayat	FD		GSS	ICP		LDI		LP		MI		NADEP
	No.	Extent	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.
Alanganur	2	25	189	386	1,542	8	19	167	668	2	6	2
Anaiseri	1	13	127	-	-	5	12	234	937	4	10	1
Arapothu	1	15	11	482	1,927	4	11	169	675	4	10	1
Athanakurichi	1	15	38	199	796	21	53	468	1,873	7	18	1
Athankothankudi	1	11	16	-	-	3	8	347	1,388	3	8	1
Athikulam	3	26	56	196	785	17	43	379	1,515	18	44	3
Kaakkor	2	24	97	-	-	10	26	766	3,066	11	29	2
Karumal	1	14	34	324	1,295	1	2	351	1,402	8	19	1
Kathankulam	1	2	18	600	2,398	1	2	294	1,175	1	2	1
Keelakanchirankulam	1	12	26	251	1,005	8	20	363	1,453	8	20	1
Keelakodumalur	1	11	96	362	1,447	8	20	427	1,710	5	12	1
Keelakulam	1	9	41	747	2,989	10	25	629	2,514	8	19	1
Keelathooval	2	19	79	499	1,995	10	25	433	1,733	3	6	2
Keeranoor	3	34	177	-	-	5	13	434	1,738	4	11	3
Mahindi	2	17	152	319	1,276	6	16	1,059	4,236	2	5	2
Manaloor	3	31	52	283	1,130	24	61	313	1,250	7	17	3
Melakanniser	4	36	82	211	843	22	56	309	1,236	11	26	4
Melakodumalur	1	8	72	274	1,095	4	9	208	832	3	6	1
Michaelpattinam	-	3	27	-	-	1	2	615	2,459	-	1	-
Nallukuruchi	2	23	180	176	704	22	55	342	1,366	13	33	2
Nallur	2	23	30	123	492	9	22	342	1,367	6	14	2
Periya Ilai	1	9	13	236	943	-	1	240	958	5	13	1
Pirabakkallur	2	22	65	442	1,766	7	17	116	462	2	4	2
Ponnakkaneri	4	41	27	180	721	6	16	199	794	2	5	4
Pooseri	1	15	35	148	590	9	22	414	1,656	2	4	1
Posukudi	1	13	24	700	2,801	8	20	183	734	3	8	1
Puliyangudi	6	61	94	-	-	2	6	419	1,677	1	2	6
Puludhikulam	1	10	18	158	633	4	10	104	416	1	3	1

Gram Panchayat	FD		GSS	ICP		LDI		LP		MI		NADEP
	No.	Extent	No.	Plants	Length	No.	Area	Plants	Length	No.	Area	No.
S.R.N.Palangulam	1	3	11	-	-	3	8	575	2,300	1	4	1
Sambakulam	2	15	47	176	705	8	20	101	403	2	6	2
Sathanur	2	17	30	-	-	7	17	1,050	4,200	2	5	2
Sellur	3	26	92	581	2,323	6	16	225	900	2	6	3
Sembongudi	1	10	27	167	668	2	6	201	803	1	1	1
Sirugudi	1	7	28	-	-	2	6	416	1,665	2	4	1
Siruthalai	2	20	127	205	819	5	12	362	1,450	2	4	2
Theriruveli	3	28	340	524	2,095	12	29	800	3,201	7	18	3
Thiruvaragam	1	6	20	344	1,374	8	20	353	1,413	2	5	1
Ulaiyur	2	22	56	-	-	10	25	286	1,145	3	6	2
Vengalakurichi	3	27	117	253	1,013	8	20	1,201	4,802	3	7	3
Vikiramapandiapuram	2	22	155	180	718	10	25	376	1,505	8	19	2
Vilakanendal	2	16	59	142	569	4	10	156	625	3	8	2
Vilangalathur	3	27	27	-	-	13	33	426	1,702	7	18	3

Gram Panchayat	ND		PS	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	Plants	HH	No.	No.	No.	No.	No.	No.	Area	No.	No.	Length
Alanganur	2,365	473	52	3	7	-	2	-	-	5	47	1542
Anaiseri	2,950	590	6	5	6	-	2	-	-	6	59	-
Arapothu	1,870	374	3	7	9	-	2	-	-	4	37	1927
Athanakurichi	2,680	536	11	6	5	-	2	-	-	5	54	796
Athankothankudi	4,900	980	3	6	5	-	2	-	-	10	98	-
Athikulam	4,410	882	21	7	8	-	2	-	-	9	88	785
Kaakkor	4,980	996	18	2	40	-	2	-	-	10	100	-
Karumal	1,870	374	5	2	4	-	2	-	-	4	37	1295
Kathankulam	2,955	591	2	2	5	-	2	-	-	6	59	2398
Keelakanchirankulam	4,410	882	10	1	5	-	2	-	-	9	88	1005
Keelakodumalur	4,035	807	8	9	8	-	2	-	-	8	81	1447
Keelakulam	4,495	899	10	8	9		2			9	90	2989
Keelathooval	1,505	301	8	4	12	-	2	-	-	3	30	1995
Keeranoor	2,950	590	50	6	6	-	2	-	-	6	59	-
Mahindi	4,900	980	22	4	12	-	2	-	-	10	98	1276
Manaloor	2,990	598	9	2	7	-	2	-	-	6	60	1130
Melakanniser	2,990	598	22	6	6	-	2	-	-	6	60	843
Melakodumalur	2,125	425	-	2	5	-	2	-	-	4	43	1095
Michaelpattinam	4,900	980	4	1	7	-	2	-	-	10	98	-
Nallukuruchi	3,145	629	20	4	10	-	2	-	-	6	63	704
Nallur	1,285	257	14	3	2	-	2	-	-	3	26	492
Periya Ilai	4,900	980	2	2	2	-	2	-	-	10	98	943
Pirabakkallur	4,015	803	11	3	9	-	2	-	-	8	80	1766
Ponnakkaneri	3,355	671	4	5	7	-	2	-	-	7	67	721
Pooseri	3,355	671	7	3	7	-	2	-	-	7	67	590
Posukudi	2,680	536	15	5	6	-	2	-	-	5	54	2801
Puliyangudi	1,795	359	14	2	10	-	2	-	-	4	36	-
Puludhikulam	4,970	994	6	2	6	-	2	-	-	10	99	633

Gram Panchayat	ND		PS	RPWDT	Roo	RP	RRWH	SPD		SPC	SPI	WCICD
	Plants	HH	No.	No.	No.	No.	No.	No.	Area	No.	No.	Length
S.R.N.Palangulam	4,105	821	3	1	4		2			8	82	-
Sambakulam	2,550	510	7	2	8	-	2	-	-	5	51	705
Sathanur	2,550	510	10	3	4	-	2	-	-	5	51	-
Sellur	4,310	862	21	1	7	-	2	9032	11.29	9	86	2323
Sembongudi	3,110	622	2	2	3	-	2	-	-	6	62	668
Sirugudi	2,220	444	9	4	3	-	2	-	-	4	44	-
Siruthalai	4,310	862	35	6	6	-	2	1848	2.31	9	86	819
Theriruveli	6,085	1,217	5	6	19	-	2	-	-	12	122	2095
Thiruvaragam	3,415	683	8	1	6	-	2	-	-	7	68	1374
Ulaiyur	3,110	622	4	3	6	-	2	-	-	6	62	-
Vengalakurichi	4,900	980	41	3	5	-	2	-	-	10	98	1013
Vikiramapandiapuram	3,655	731	21	8	15	-	2	-	-	7	73	718
Vilakanendal	2,220	444	19	1	5	-	2	-	-	4	44	569
Vilangalathur	5,230	1,046	26	4	8	-	2	-	-	10	105	-

ANNEXURE 7.1

GP WISE WASCA RECOMMENDATION AND WORKS UPLOADED

Sl. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 16-03-2021
1	Alangaanoor	1,447	262
2	Anaiseri	669	136
3	Arapothu	1,358	267
4	Athanakurichi	2,986	10
5	Athankothankudi	532	240
6	Athikulam	641	4
7	Kakkur	1,786	5
8	Karumal	786	4
9	Kathakulam	557	1
10	Keelakanchirankulam	750	110
11	Keelakodumalur	1,886	-
12	Keelakulam	3,455	331
13	Keelathooval	2,426	317
14	Keeranur	1,718	162
15	Kolunthurai	2,336	515
16	Kumarakurichi	496	162
17	Makindi	1,062	329
18	Manaloor	2,916	240
19	Melakkanniseri	2,493	6
20	Melakodumalur	5,466	385
21	Michealpattanam	887	187
22	Nallukurichi	956	1
23	Nallur	1,193	196
24	Periya Ilai	725	-
25	Pirabukkalur	2,234	463
26	Ponnakkaneri	1,561	-
27	Pooseri	1,530	49
28	Posukkudi	1,189	368
29	Pulithikulam	2,155	100
30	Puliyangudi	1,095	341
31	Sambakulam	2,576	179
32	Sathanur	1,656	-
33	Sellur	1,379	294
34	Selvanayagapuram	1,065	137
35	Semponkudi	932	44
36	Sirugudi	979	162
37	Siruthalai	1,151	293
38	S.R.N.Palankulam	180	2
39	Theriruveli	654	17
40	Thiruvarangam	1,168	149
41	Ulaiyur	1,536	318
42	Valanadu	1,043	401
43	Vengalakurichi	1,988	8

Sl. No	GP	WASCA Recommendation for 3 Years	WASCA Uploaded for FY-2021-22 as on 16-03-2021
44	**Vikkiramapandiapuram**	900	209
45	**Vilakkanenthal**	623	250
46	**Vilankulathur**	4,961	351

ANNEXURE 7.2

GP AND WORK CATEGORY-WISE ONGOING WORKS IN MUDUKULATHUR BLOCK

GP	Work Category	Ongoing works
Alangaanoor	Water Conservation and Water Harvesting	2
Anaicherry	Rural Connectivity	1
	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Arapothu	Water Conservation and Water Harvesting	2
Athanakurichi	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	9
Athankothankudi	Water Conservation and Water Harvesting	1
Athikulam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	2
Kakkur	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	1
Karumal	Water Conservation and Water Harvesting	1
Kathakulam	Water Conservation and Water Harvesting	2
Keelakanchirankulam	Water Conservation and Water Harvesting	2
Keelakodumalur	Water Conservation and Water Harvesting	2
Keelakulam	Water Conservation and Water Harvesting	3
Keelathooval	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
Keeranur	Rural Sanitation	31
	Water Conservation and Water Harvesting	2
Kolunthurai	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	5
Kumarakurichi	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	4
Makindi	Rural Connectivity	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	3
Manaloor	Anganwadi/Other Rural Infrastructure	1
	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Melakkanniseri	Drought Proofing	1
	Water Conservation and Water Harvesting	1
Melakodumalur	Water Conservation and Water Harvesting	3
Michealpattnam	Water Conservation and Water Harvesting	1
Nallukurichi	Water Conservation and Water Harvesting	3
Nallur	Water Conservation and Water Harvesting	1
Periya Ilai	Water Conservation and Water Harvesting	1
Pirabukkalur	Water Conservation and Water Harvesting	2
Ponnakkaneri	Water Conservation and Water Harvesting	3
Pooseri	Water Conservation and Water Harvesting	2

GP	Work Category	Ongoing works
Posukkudi	Water Conservation and Water Harvesting	1
Pulithikulam	Water Conservation and Water Harvesting	2
Puliyangudi	Water Conservation and Water Harvesting	2
S.R.N.Palankulam	Water Conservation and Water Harvesting	1
Sathanur	Water Conservation and Water Harvesting	1
Selvanayagapuram	Water Conservation and Water Harvesting	2
Semponkudi	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	2
Siruthalai	Water Conservation and Water Harvesting	2
Theriruveli	Water Conservation and Water Harvesting	4
	Works on Individuals Land (Category IV)	1
Thiruvarangam	Water Conservation and Water Harvesting	2
	Works on Individuals Land (Category IV)	1
Ulaiyur	Water Conservation and Water Harvesting	1
Valanadu	Water Conservation and Water Harvesting	1
	Works on Individuals Land (Category IV)	3
Vengalakurichi	Water Conservation and Water Harvesting	2
Vikkiramapandiapuram	Water Conservation and Water Harvesting	2
Vilakkanenthal	Water Conservation and Water Harvesting	1
Vilankulathur	Water Conservation and Water Harvesting	4

ANNEXURE 8

CWRM KEY INDICATORS FOR GPs IN VENGALAKURICHI MICRO-WATERSHED

CWRM Parameter	Vengalakurichi
Soil Resources: Status of Available Nitrogen (%)	
Very Low	89
Low	11
Status of Organic Carbon (%)	
Very Low	80
Low	16
Medium	5
Status of Soil Micro Nutrients (%)	
Sufficient	68
Deficient	32
Status of Physical condition of the soil (%)	
Moderately Acidic	7
Slighly Acidic	7
Neutral	3
Moderately Alkaline	82
Strongly Alkaline	2
Soil Texture (%)	
Fine Soil	76
Coarse loamy	18
Soil Water Permeability (Low, Moderate, high)	Moderate
Soil moisture and ET	
Volumetric Soil Moisture (%)	17
Estimated Soil Moisture (ha.m)	169
ET Losses (ha.m)	407
Means of Water Extraction (%)	
Gravity	71
Lifting	29
Irrigation Methods (%)	
Wild Flooding	100
Livestock (No.)	
Cattle Population	110
Sheep Population	354
Goat Population	1,080
Poultry	1,654
Land Resources (ha)	
Non-Agricultural Uses	227.40
Land Under Miscellaneous Tree Criticalops etc.	32.61
Fallows Land other than Current Fallows	87.12
Current Fallow land	124.00
Unirrigated Land	607.10
Area Irrigated by Source	140.93

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