CII-TRIVENI WATER INSTITUTE

Confederation of Indian Industry

FRANK WATER

Water Dialogues Series

"Corporate Engagement on Water-Climate-Livelihood Nexus"

10 December 2024, Chennai

Water Dialogue

Theme: Collective action for an improved Water Scenario

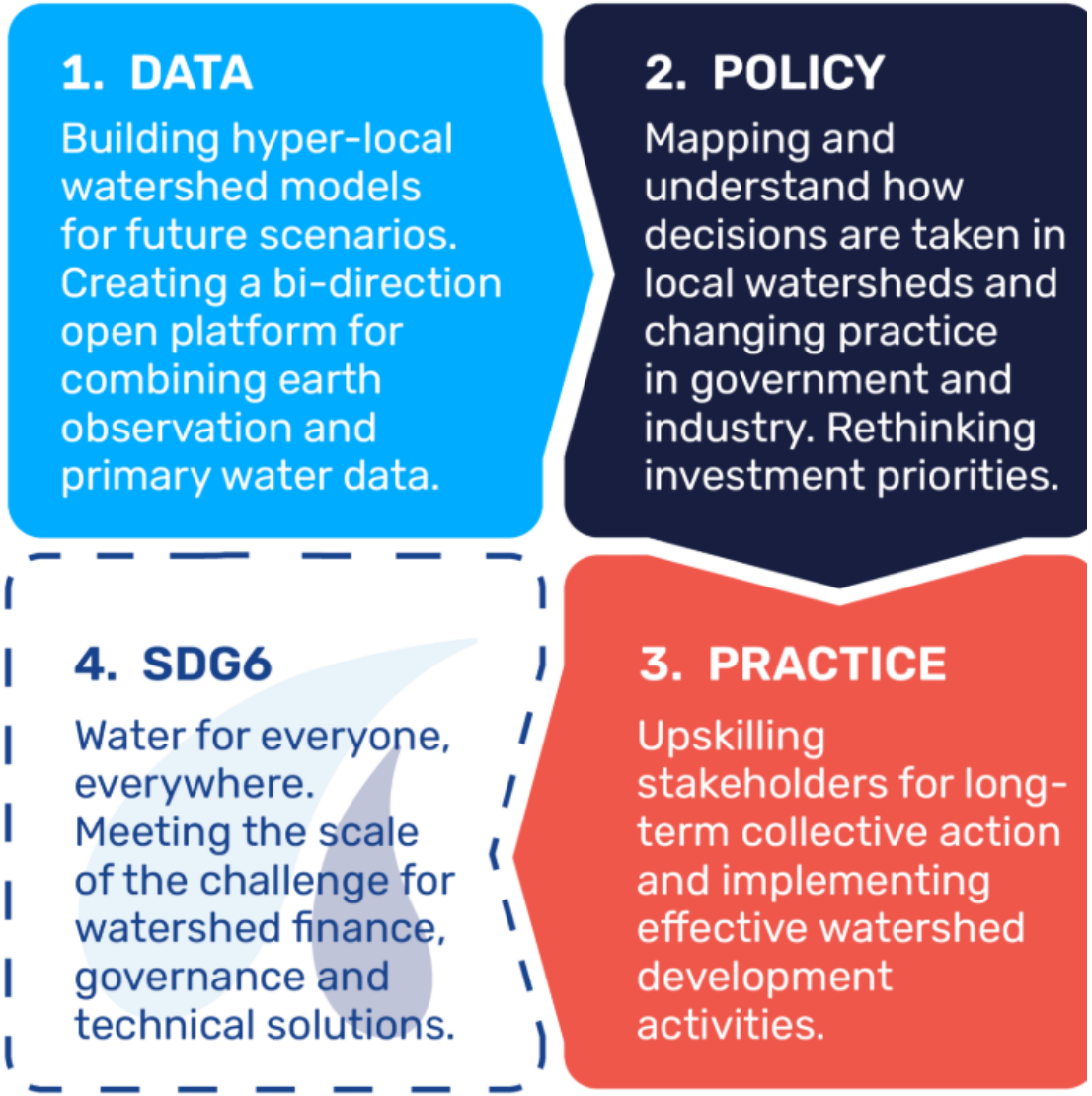
Rationale

- Water demand by stakeholders are outstripping supply (availability).
- This demand- supply gap is further widened due to rising climate extremes, impacting the lives and livelihoods across stakeholders.
- Overcoming this challenge requires collective action for uptake of appropriate strategies for effective water management and long-term water security.

These dialogue series attempts to take forward the above intend for Sriperumbudur watershed.

Context

- CII Water Institute, in partnership with Frank Water team & partners ACWADAM, Myrada, WELL Labs, FES, collaborated on the project **'Beyond the Boundary'** to find sustainable solutions to water crisis by collective action.
- This collaboration intends to work on the premise that a **water-secure future, requires stakeholders (key decision-makers and partners) to work collectively across their watersheds.**



Selection of the Location: Sriperumbudur

- Sriperumbudur town was considered as a reference point for delineating the watershed boundary in the region, which is a major industrial hub with large industrial clusters and a Special Economic Zone (SEZ), operated by the State Industries Promotion Corporation of Tamil Nadu (SIPCOT)
- Various industries such as automotive, chemicals, and electronic sectors which produce goods for global market are in the area.
- Sriperumbudur is also a high population density town undergoing rapid industrialisation – making it an ideal pilot location given the likely future demands on water resources.

Objectives

1. Identify an appropriate **Water Allocation Framework.**
2. Sustainable **water management for industries**, minimising risks to operations without **compromising the ecosystem health**.
3. Stimulate **Collective Action** for water resource management; building **trust** for managing resource **conflicts.**

1. Stakeholder Meetings and Data collection

1.1 Reconnaissance visit and Stakeholders

Departments Visited – January- March 2024

1. District Collector Office, Kanchipuram
2. Department of Agriculture & Horticulture, Kanchipuram
3. Department of Animal Husbandry
4. Department of Economics & Statistics, Kanchipuram
5. Revenue office, Kanchipuram
6. Indian Meteorological Department, Regional Meteorological Centre, Chennai
7. Water Resource Department (Surface Water), PWD, Palar Basin Circle, Chepauk, Chennai
8. Water Resource Department (Ground Water), PWD, Tharamani, Chennai
9. Tamil Nadu Industrial Development Corporation Limited (TIDCO), Egmore, Chennai
10. State Industries Promotion Corporation of Tamil Nadu (SIPCOT)

IMD regional office

Agriculture department, Kanchipuram

Meeting with District Collector, Kanchipuram

Horticultural Department, Kanchipuram

Visited Surface and Groundwater Department data centre

Meeting with PWD Dept.

SIPCOT & TIDCO office Chennai.

Meeting with surface water resources dept.

TIDCO office

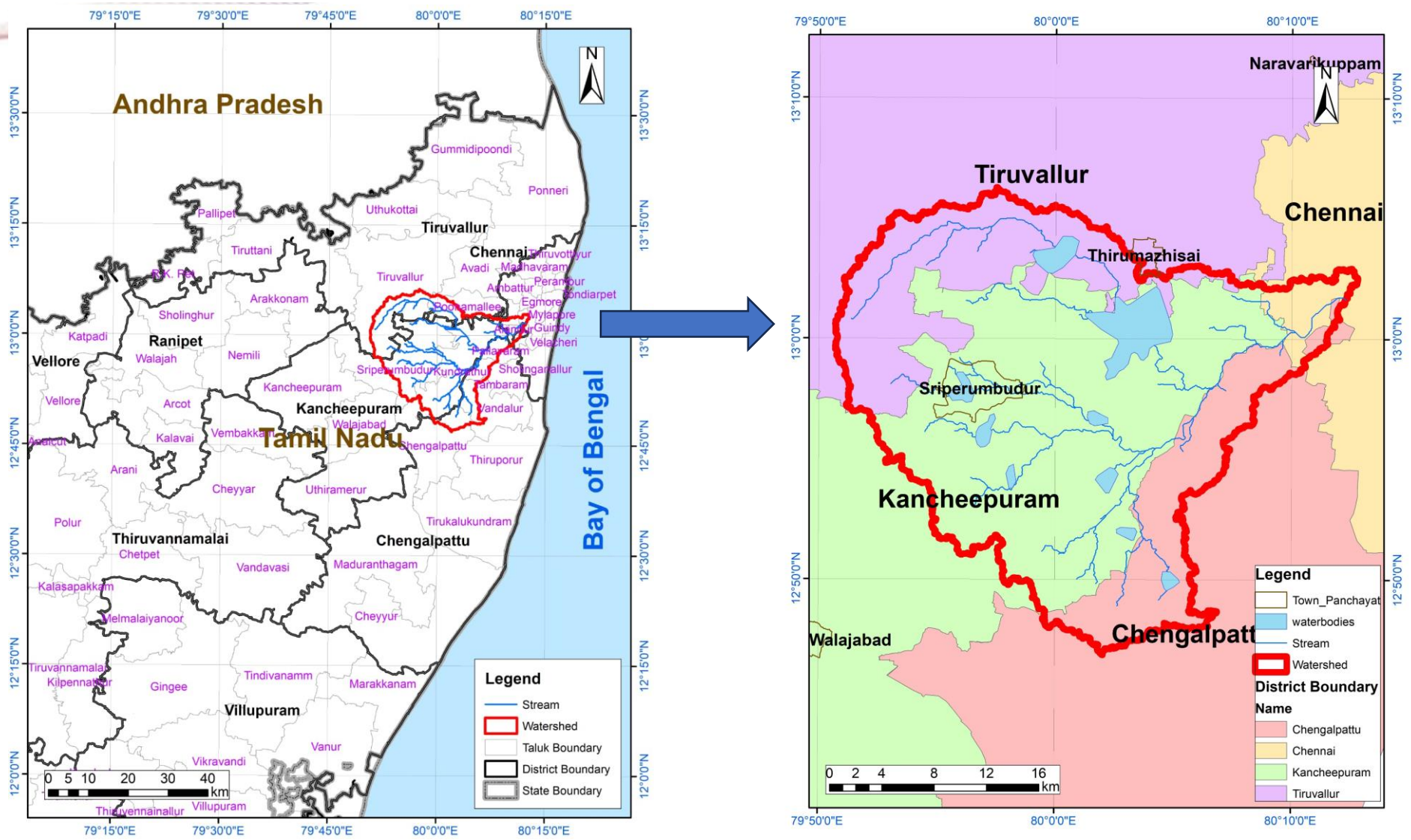
1.2 Data Collection

Type of Map	Source
Administrative Boundary	Tamil Nadu Geographical Information System (TNGIS) , Tamil Nadu e-Governance Agency (TNeGA)
Socio-Economic	Census of India
Village Boundary	Census of India, Survey of India
Landuse	Multiple Sources
Built-up	Sentinel-2 LULC
Industrial	Google and National Atlas and Thematic Mapping Organisation (NATMO)
Agriculture	Sentinel-2 LULC, IWMI - GIAM,NATMO
Water Bodies	Sentinel-2 LULC, Google
Rainfall	India Meteorological Department, Rain gauge data
Temperature	India Meteorological Department
Soil	FAO, NATMO
Topography	SRTM
Slope	DEM

2. Sriperumbudur Watershed

- Watershed delineation
- Watershed Characterization

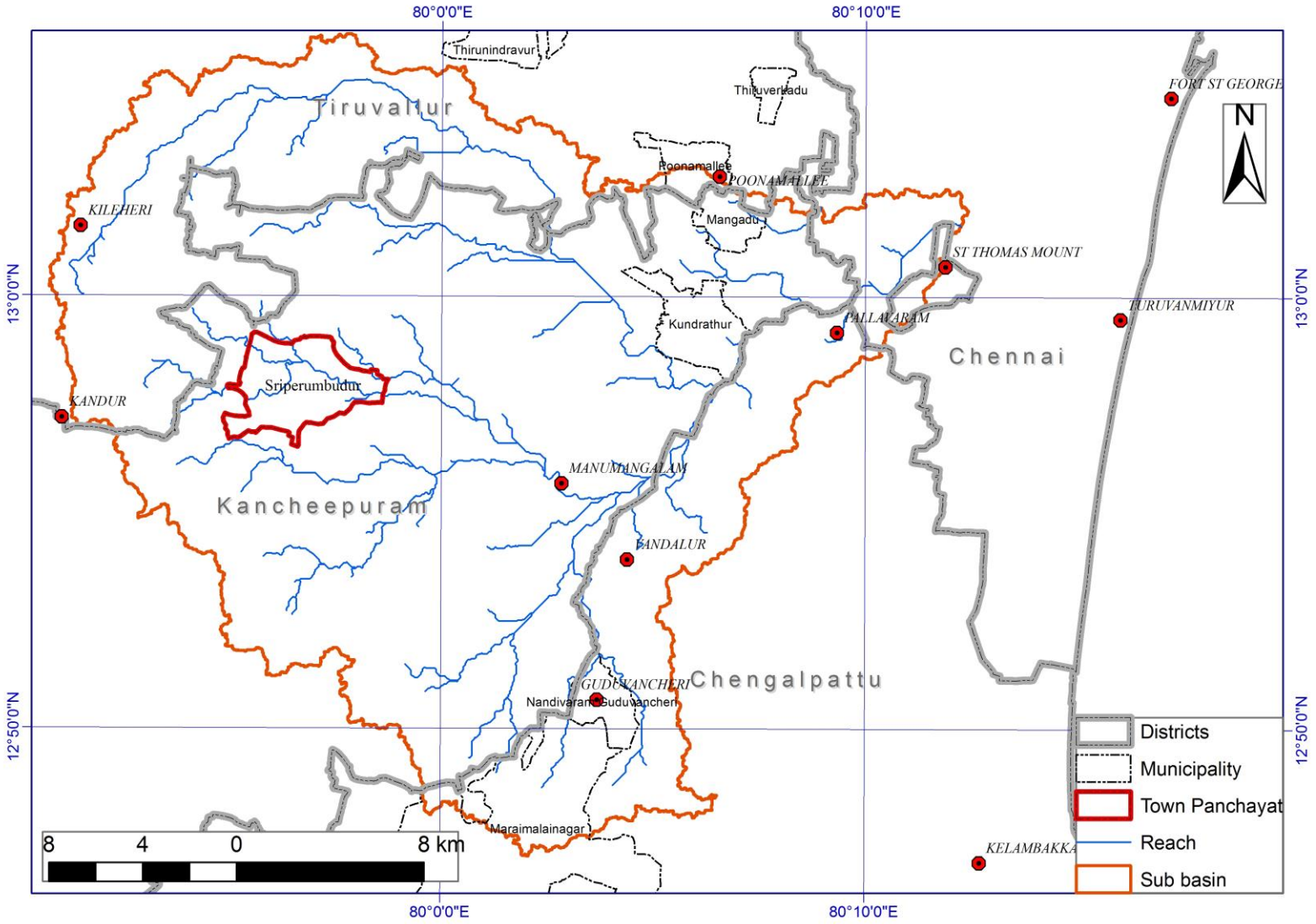
2.1. Sriperumbudur: Regional Extent



Districts Covered:

1. Kanchipuram
2. Thiruvallar
3. Chengalpattu
4. Chennai

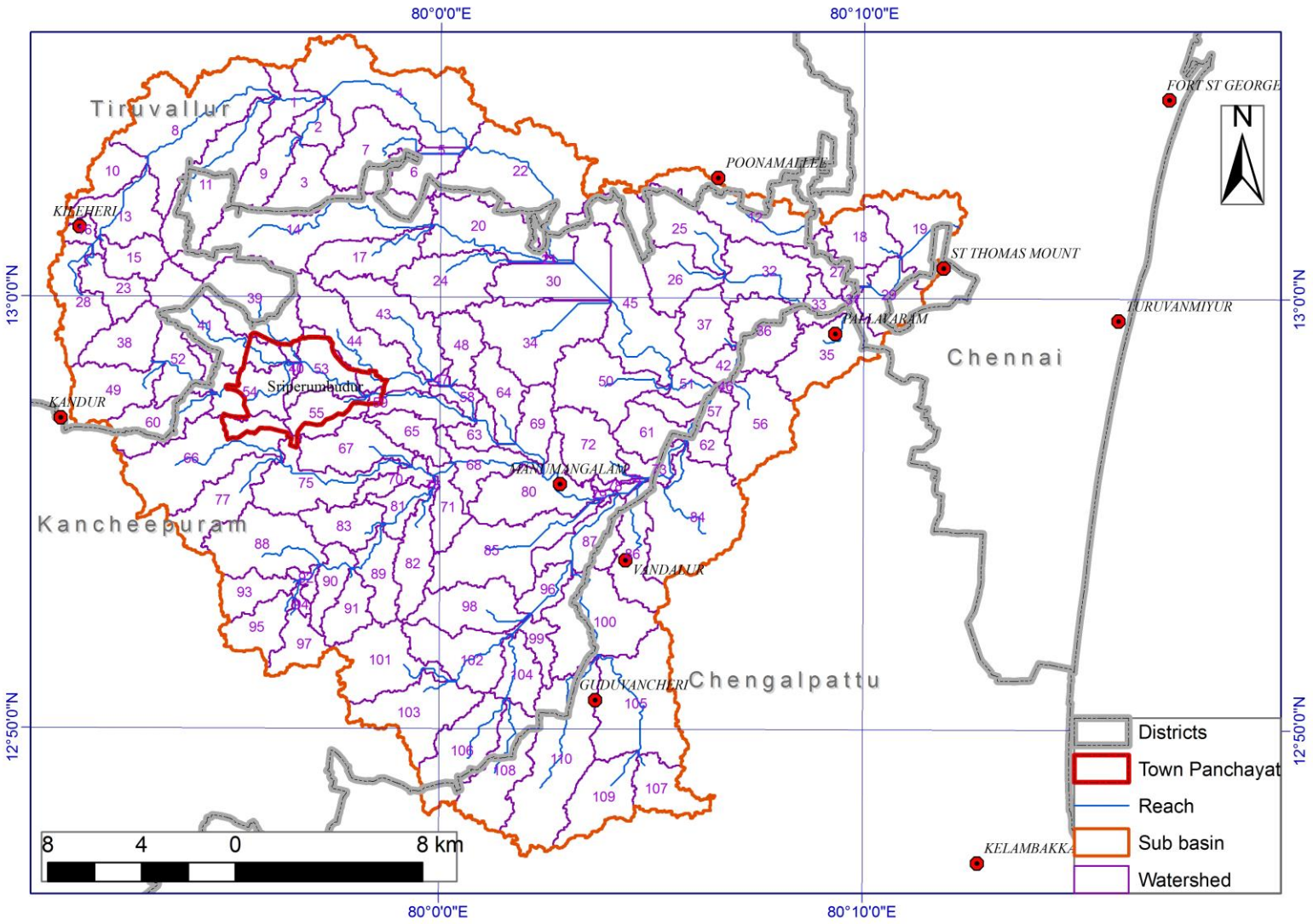
2.2 Sriperumbudur Watershed Delineation



Geographical area of **delineated watershed:768 sq. km**.

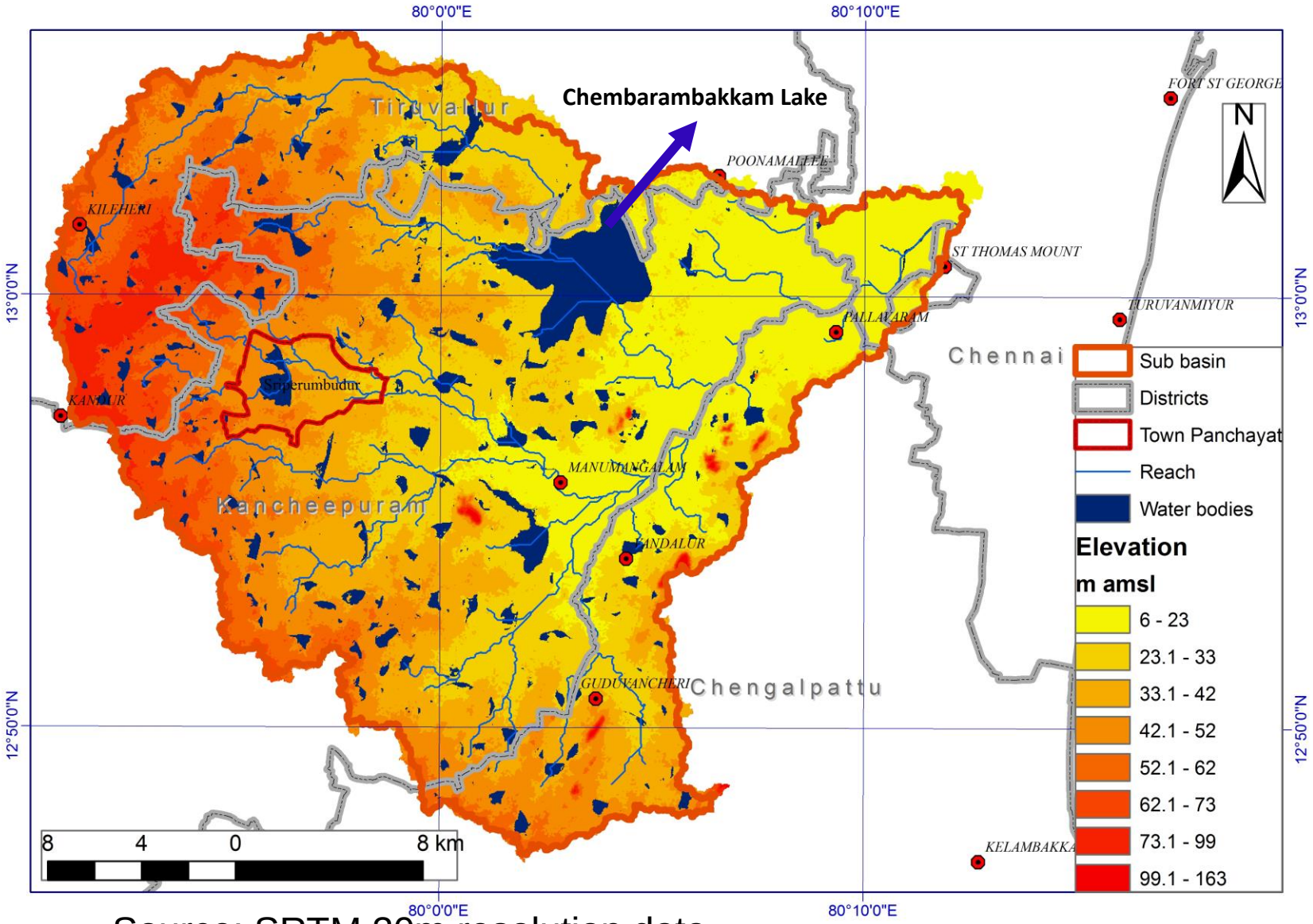
Major River System: **Adyar River**

2.3 Sriperumbudur Sub-watersheds



There are 110 sub - watersheds.

2.4 Watershed Characterization: Topography



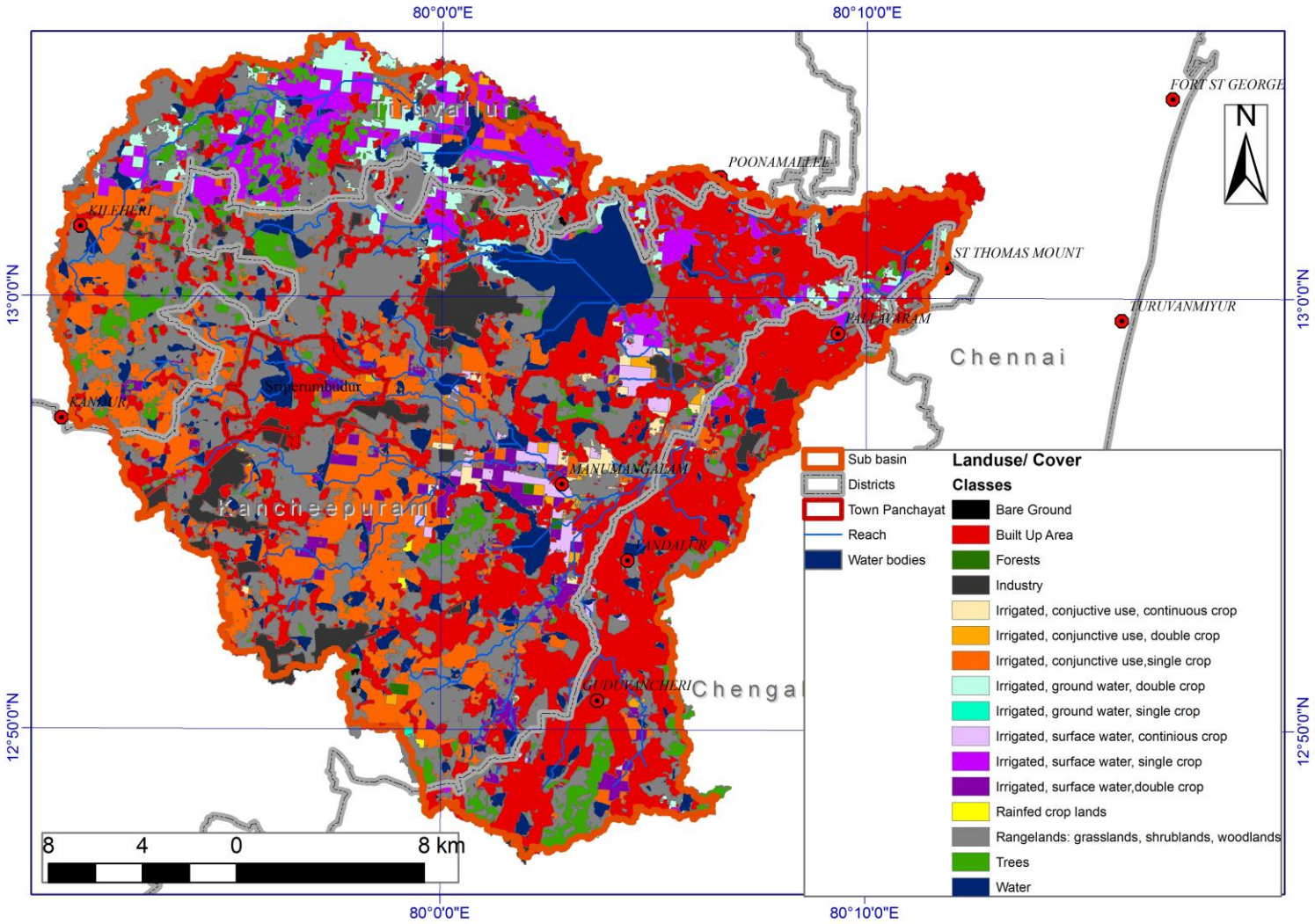
Source: SRTM 30m resolution data

Sriperumbudur watershed shows elevation between **6 m amsl to 163 m amsl.**

Higher elevations observed towards west and northwest part; lower elevations towards northeast part.

Watershed fed by several water bodies. **Chembarambakkam Lake** is a major waterbody in Sriperumbudur watershed.

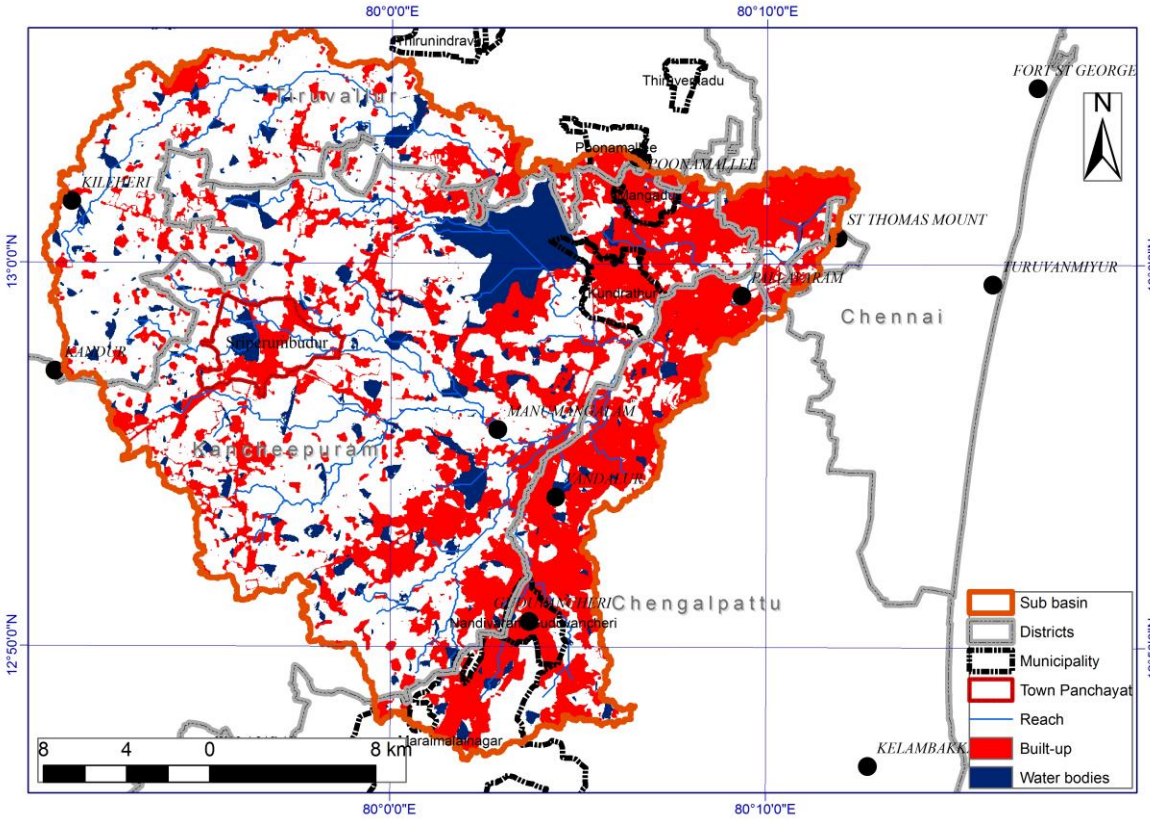
2.5a Watershed Characterization: Landuse



- 34% is Built-up Area
- 25% is under Agriculture
- 24% is under-range grasses
- Water bodies cover 8% of total watershed area.
- 5% is designated as forest
- 4% is Industry

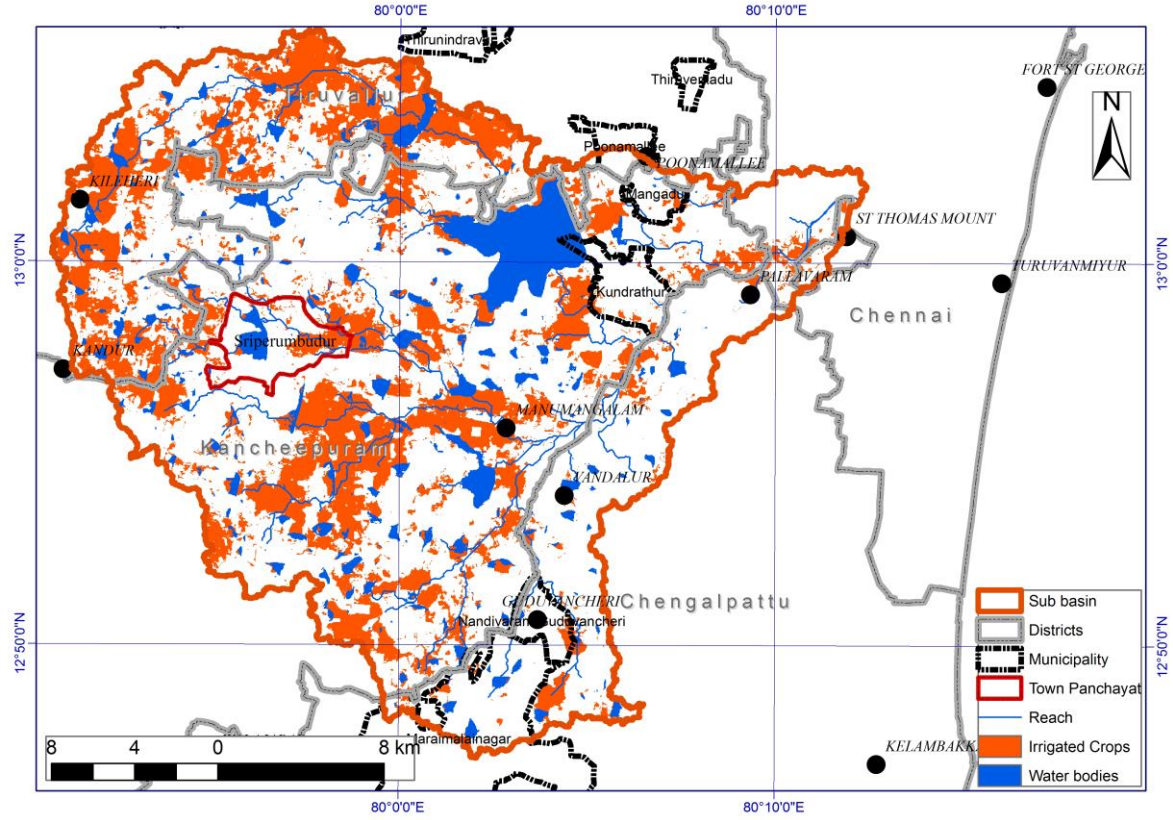
Source: Sentinel-2 data (2022)

2.5b Watershed Characterization: Landuse



Built-up area

34% of the watershed area

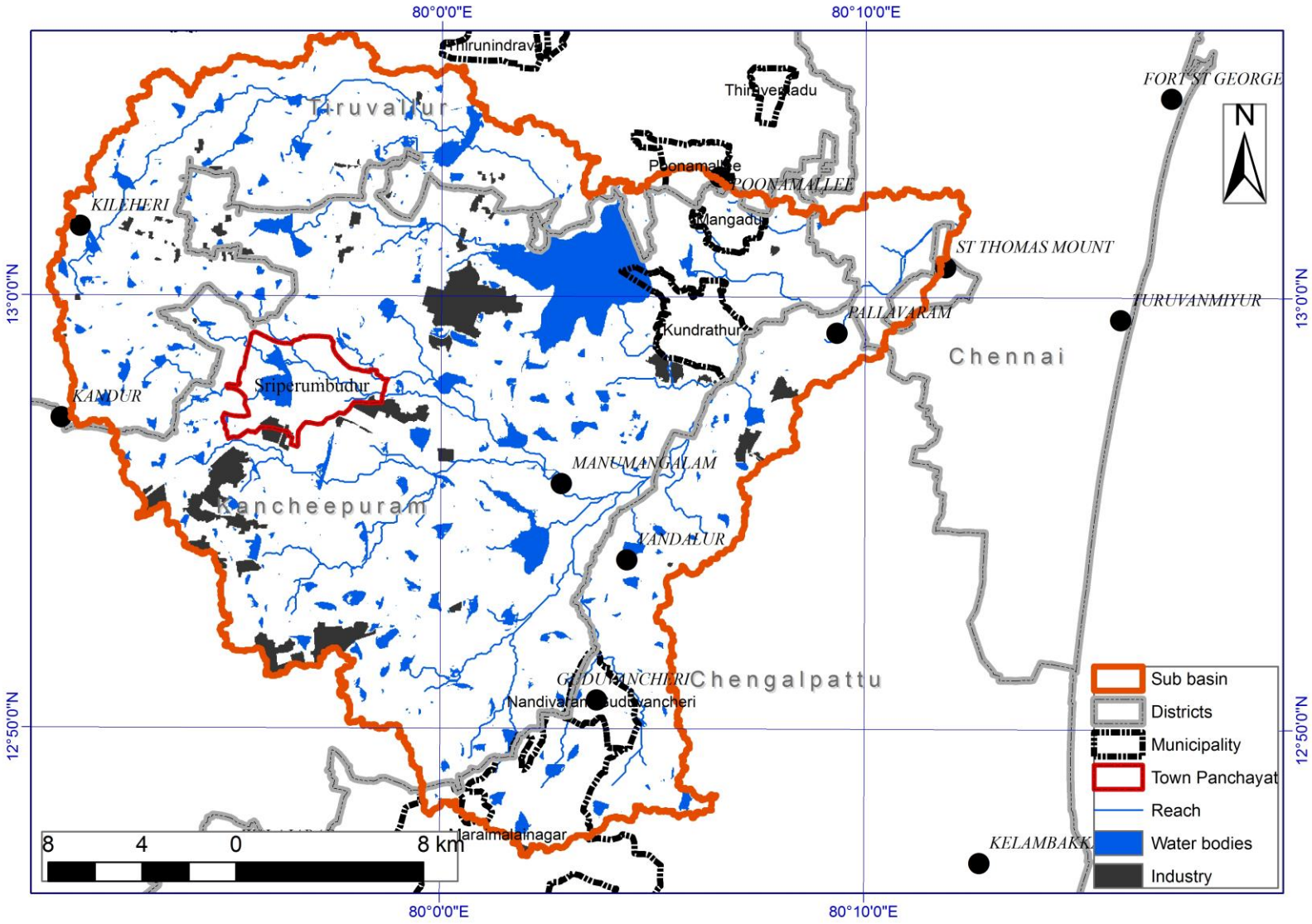


Agriculture

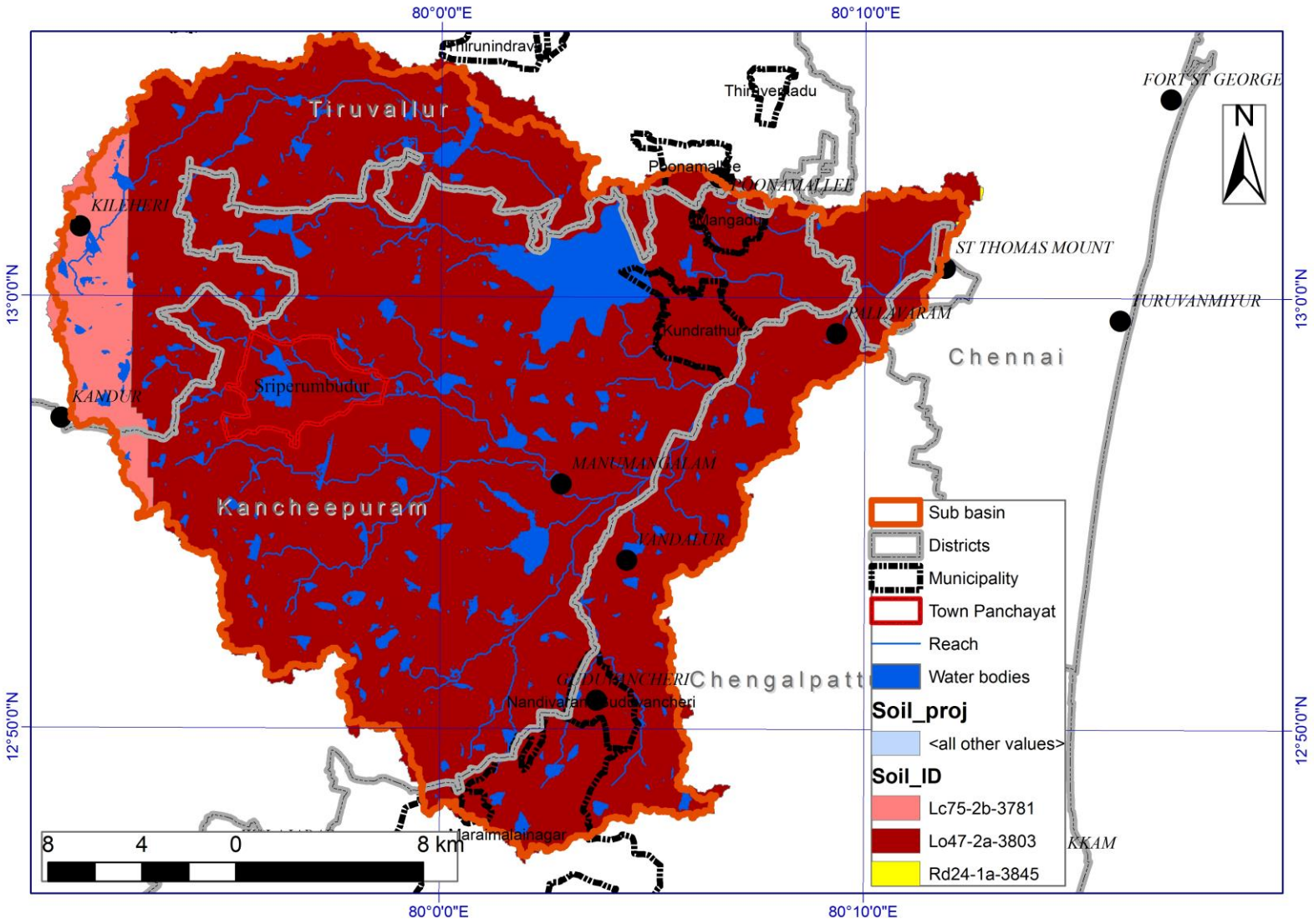
25% of the watershed area

Source: Sentinel-2 data (2022)

2.5c Watershed Characterization: Landuse – Industry



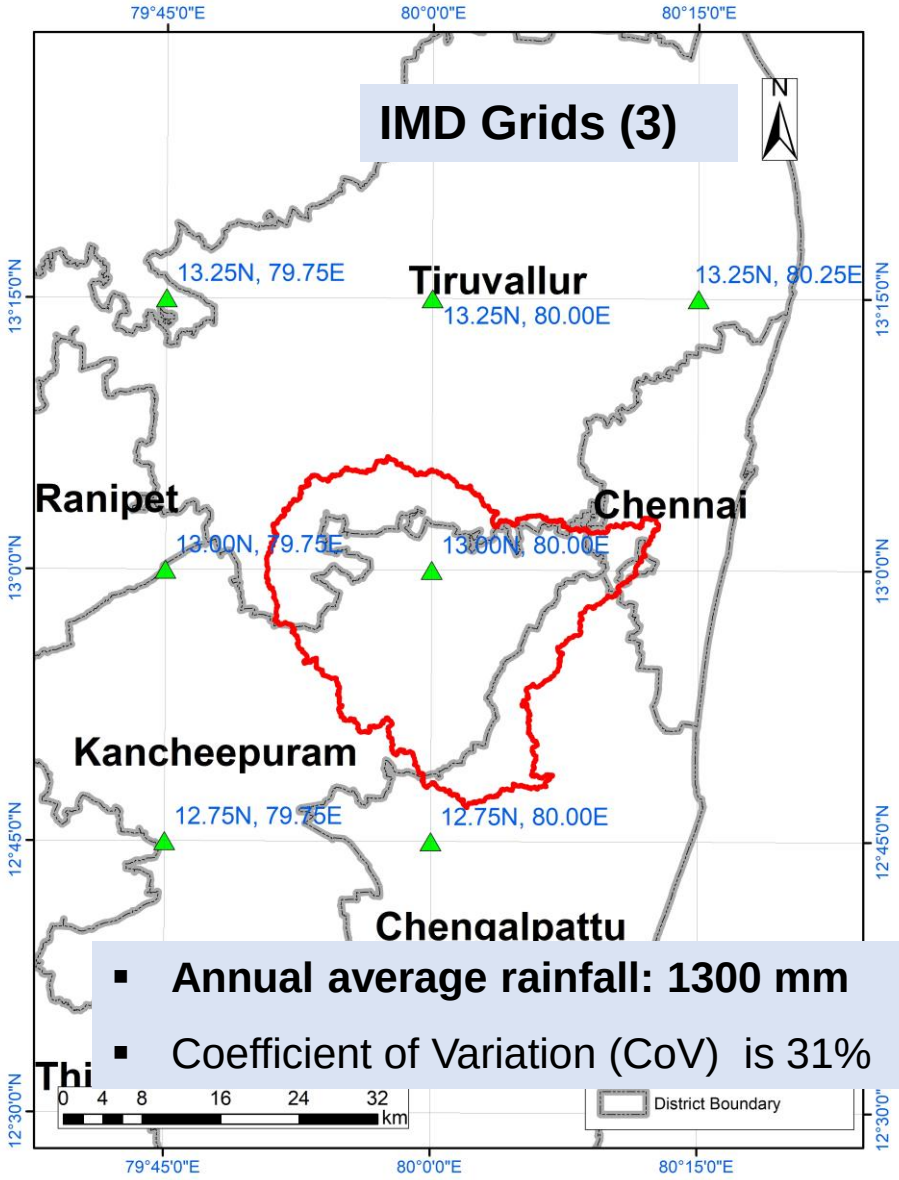
2.6 Watershed Characterization: Soils



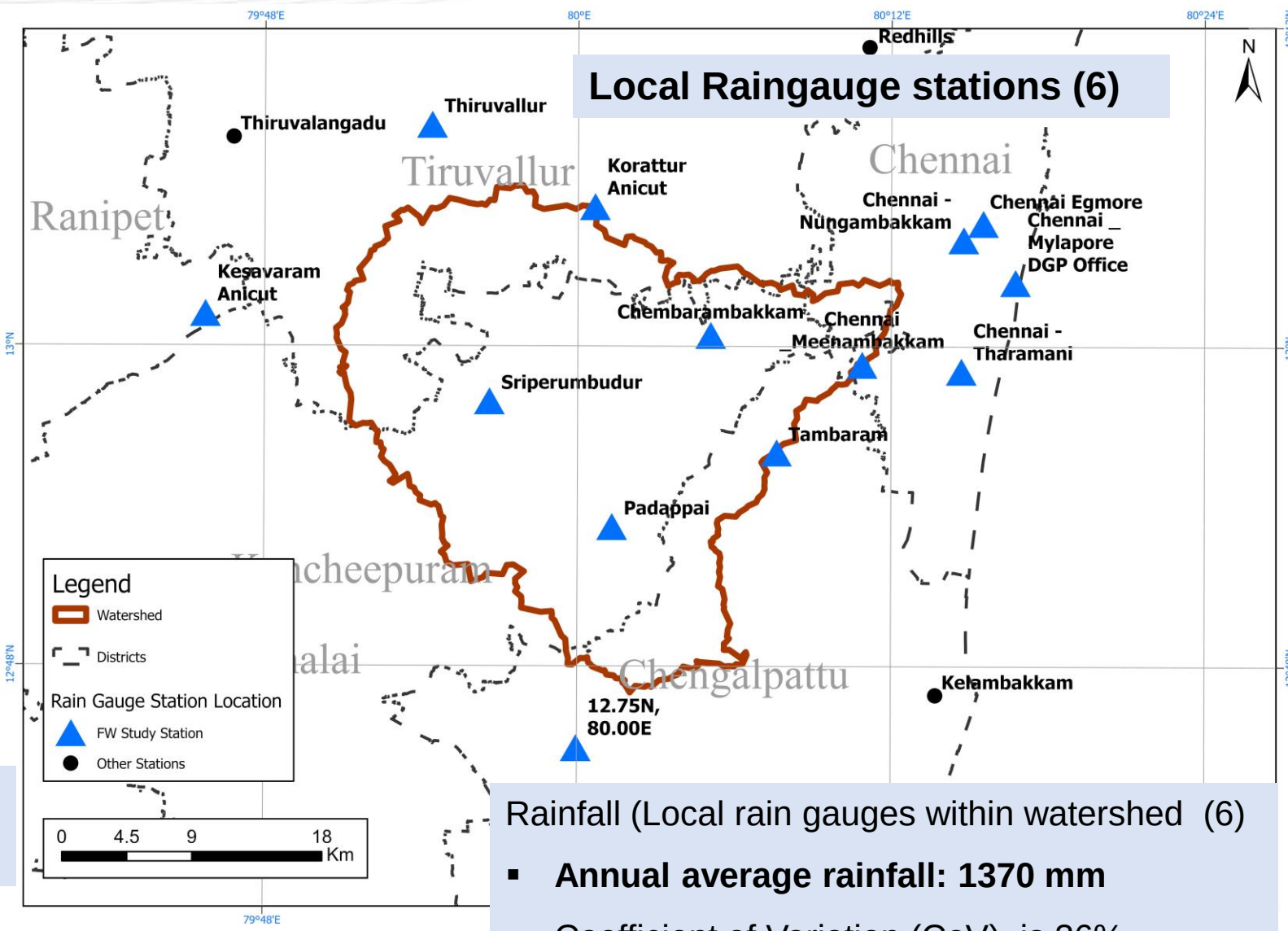
Soils in the watershed are predominantly loam and clay loam.

These soils have high runoff potential and low infiltration rates.

2.7 Watershed Characterization: Rainfall



- **Annual average rainfall: 1300 mm**
- Coefficient of Variation (CoV) is 31%



Rainfall (Local rain gauges within watershed (6)

- **Annual average rainfall: 1370 mm**
- Coefficient of Variation (CoV) is 36%

Source: IMD Gridded (0.25X0.25)

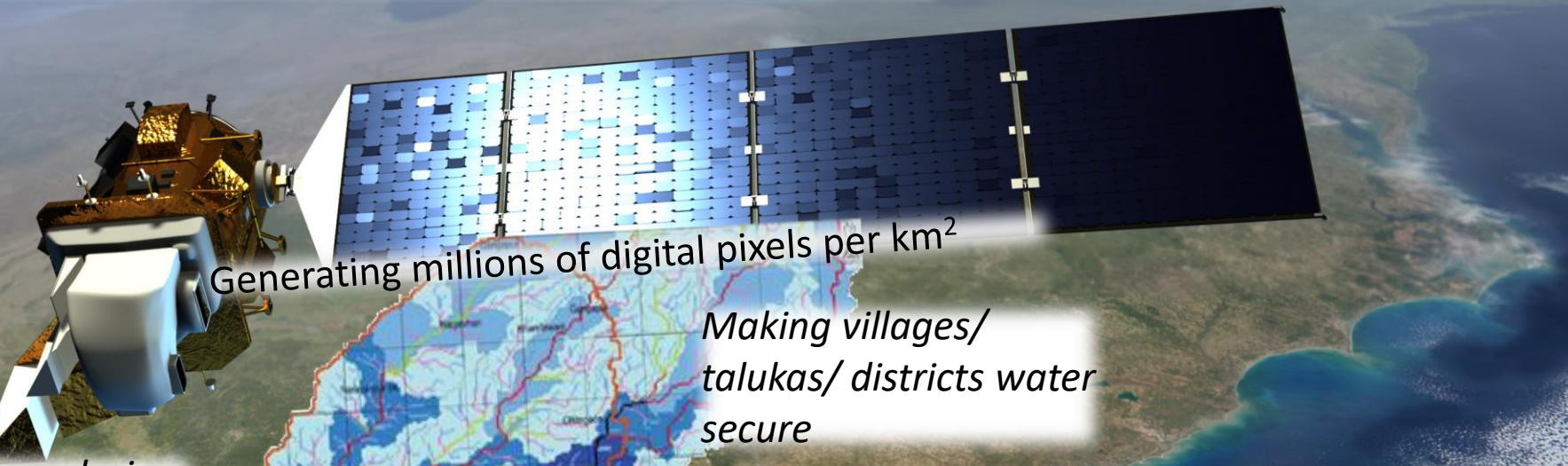
3. Hydrological Assessment of Sriperumbudur Watershed

- Application of CII's WATSCAN Tool
- Water availability and demand gap assessment
- Identifying areas for FGDs

WATSCAN – Unique Digital Tool

WATSCAN leading on-ground implementation using world class analytics

WATSCAN PROVIDING DIGITAL WATER SOLUTIONS



Generating millions of digital pixels per km^2

Making villages/ talukas/ districts water secure

delineates hydrological boundaries over administrative boundaries

Check Dams

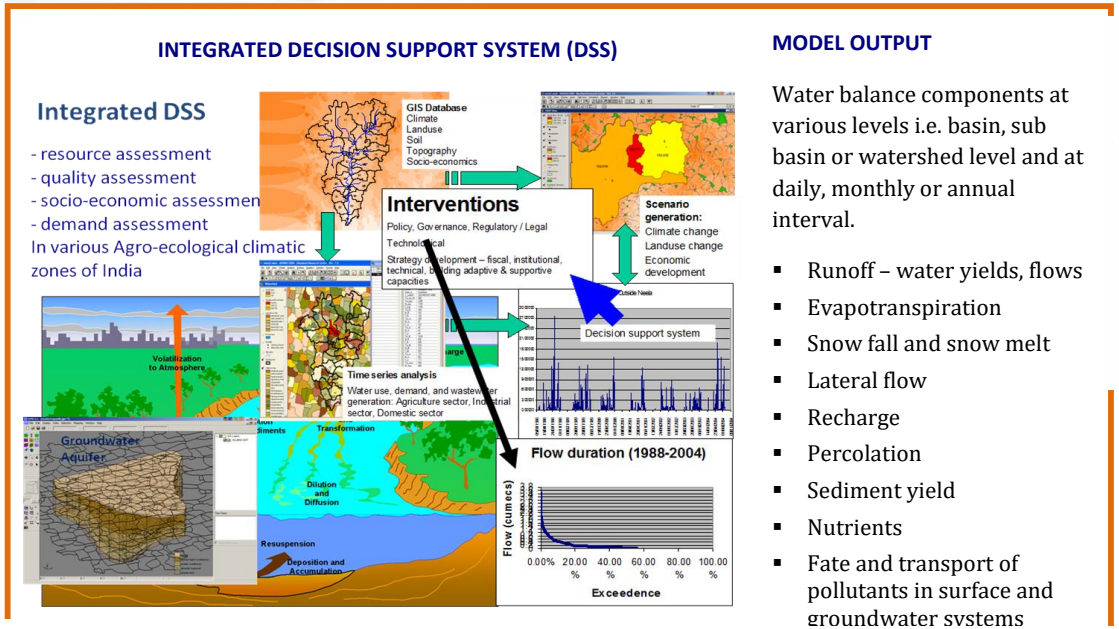
Bunds

Recharge Shafts

Where to site What intervention

Satellite based analytics: decision support system

- Hybrid Analytics and Software
- Water availability: surface flows and groundwater recharge
- Demand-supply analysis



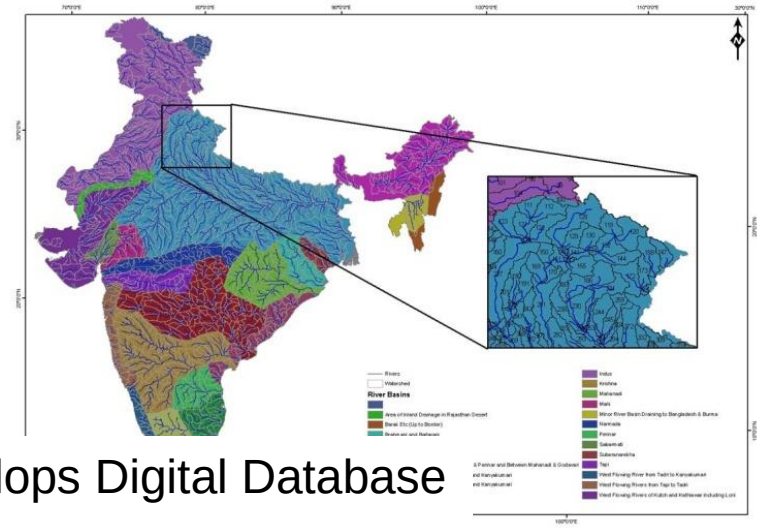
MODEL OUTPUT

Water balance components at various levels i.e. basin, sub basin or watershed level and at daily, monthly or annual interval.

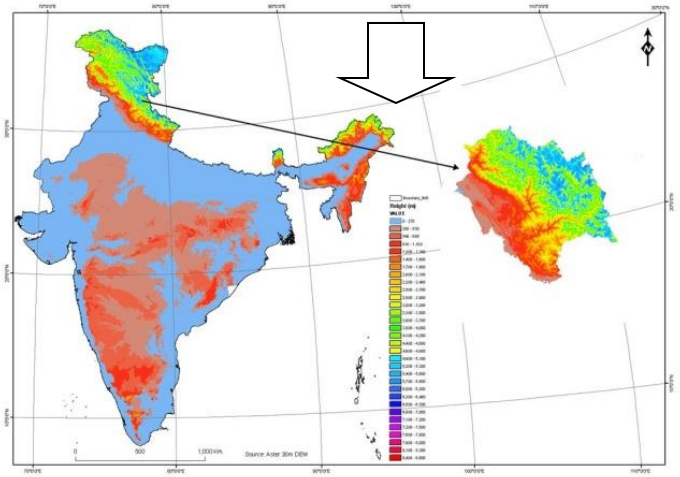
- Runoff – water yields, flows
- Evapotranspiration
- Snow fall and snow melt
- Lateral flow
- Recharge
- Percolation
- Sediment yield
- Nutrients
- Fate and transport of pollutants in surface and groundwater systems

WATSCAN

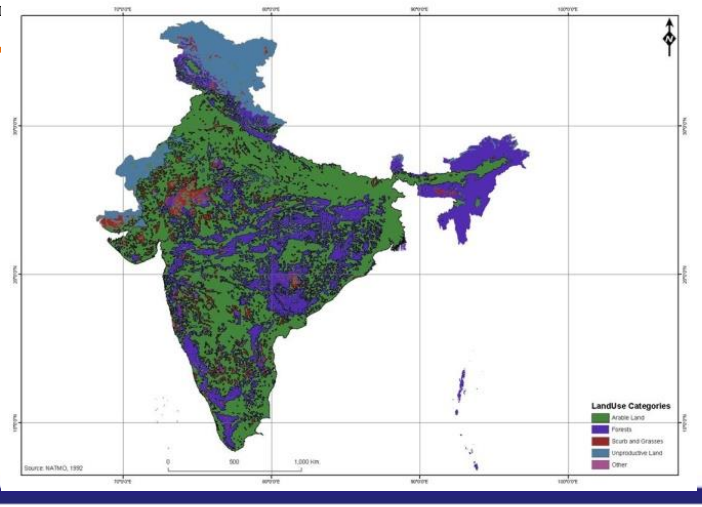
River basins



Digital Elevation Model (30m)

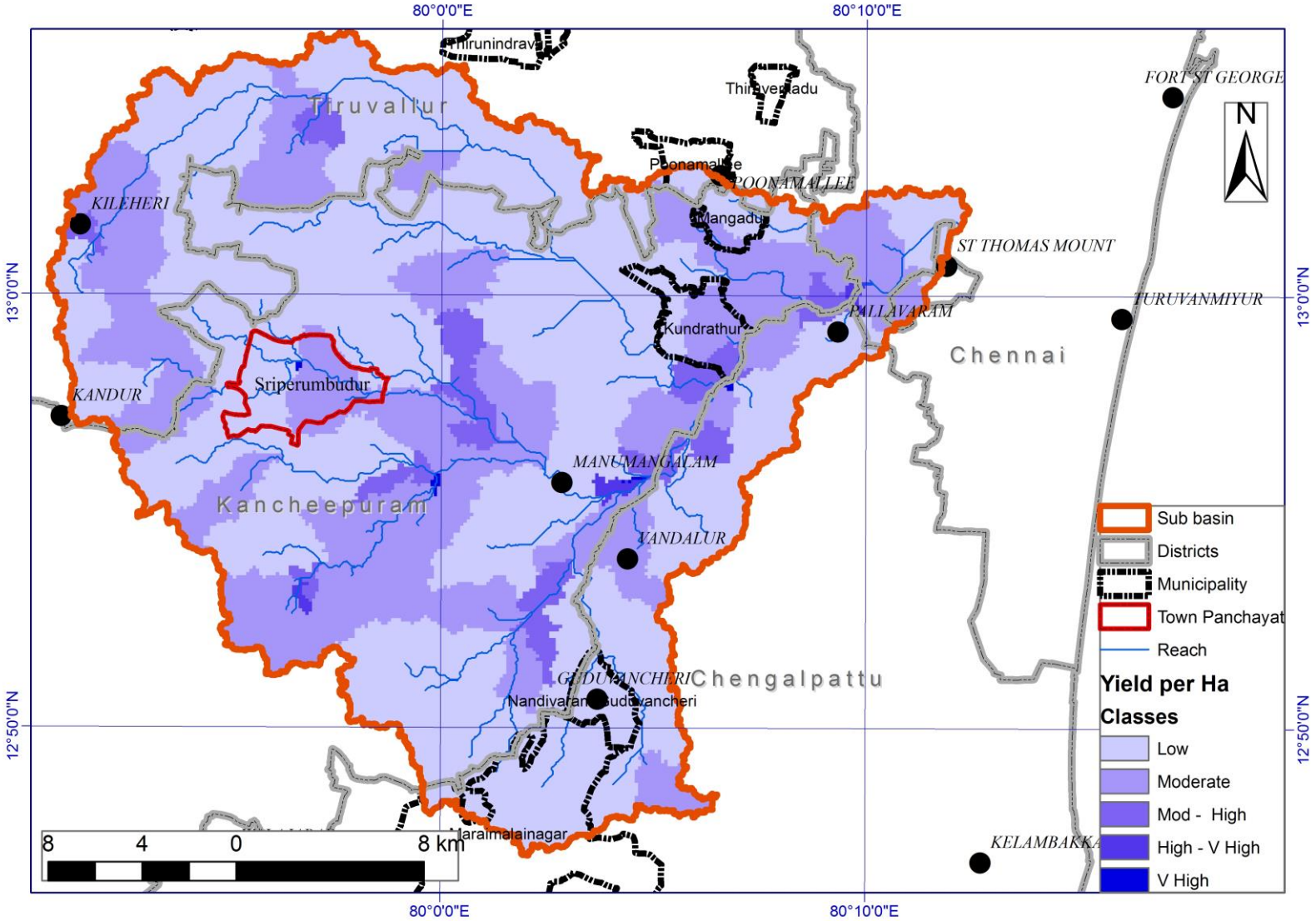


Landuse



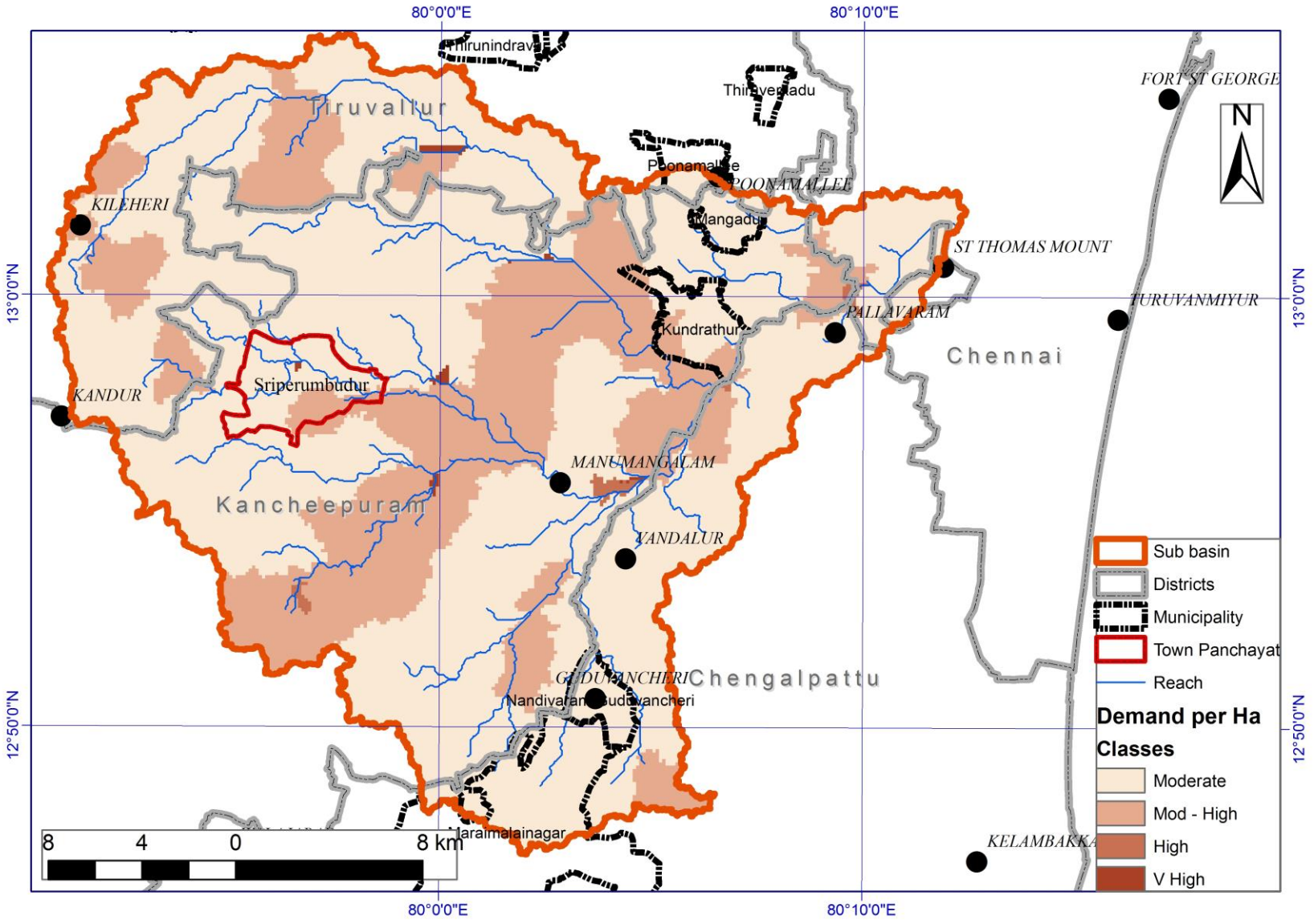
Develops Digital Database

3.1 WATSCAN Outcome: Water Availability



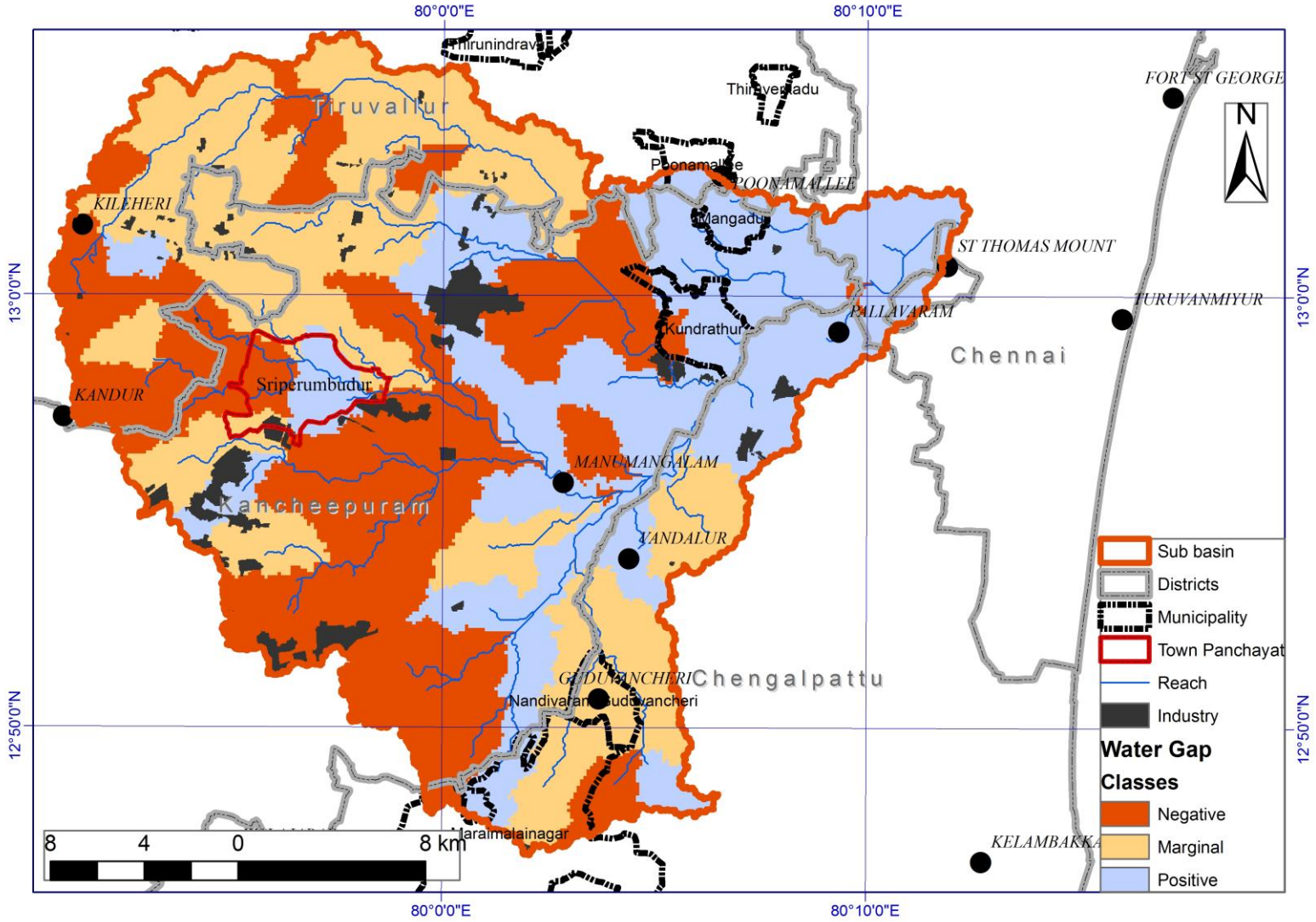
The outcome identifies pockets of water surplus and scarcity.

3.2 WATSCAN Outcome: Water Demand



The outcome identifies pockets of high and low water demand.

3.3 WATSCAN Outcome: Water Gap



Gaps between water supply and demand found especially to the west of the watershed. This corresponds with the bulk of the agricultural areas of the watershed, as well as areas of industrial development.

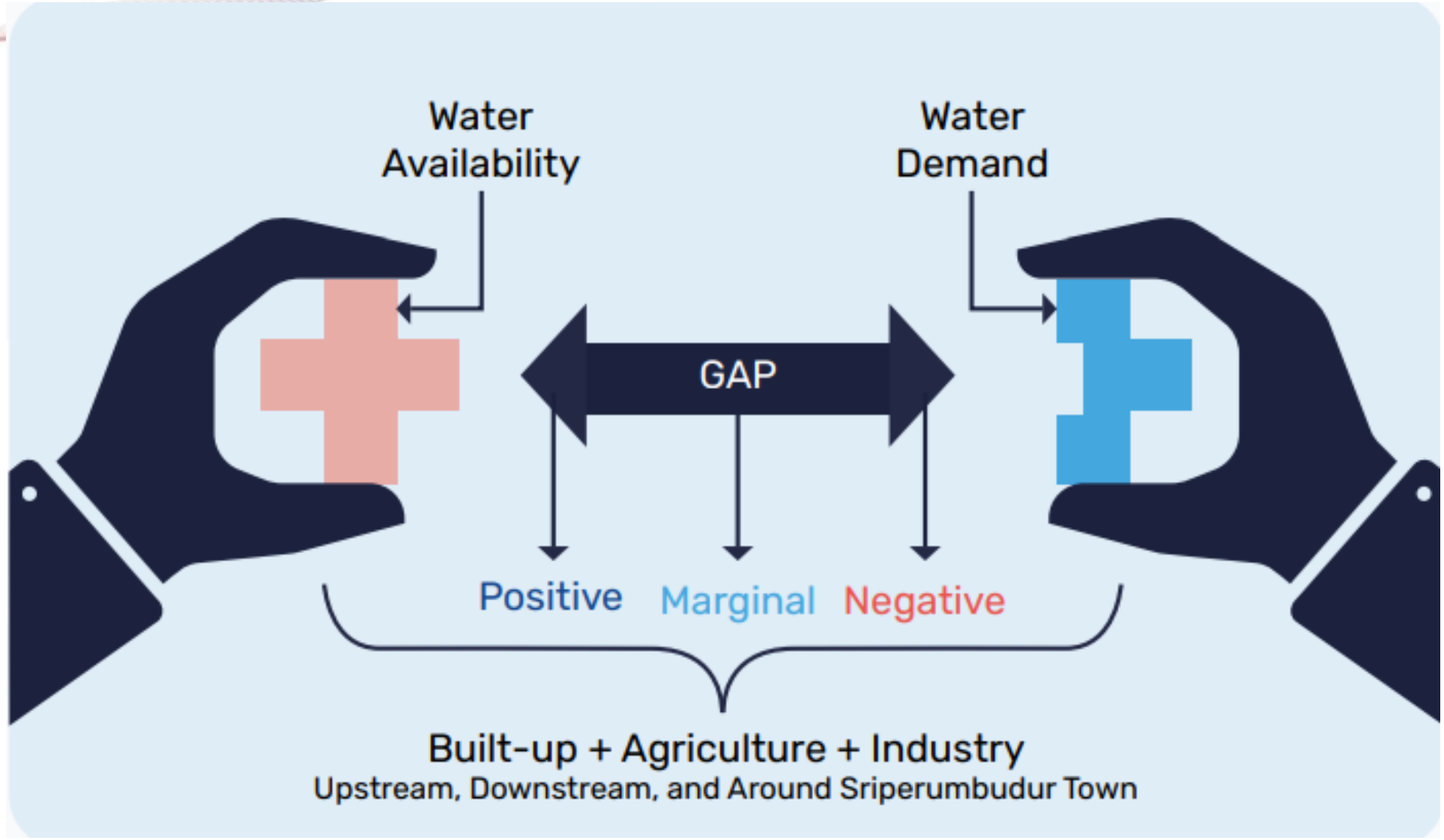
Water Gap mm/ha = Yield/ha – Demand/ha

Negative Water Gap Areas: -80 mm/ha to -0.05 mm/ha

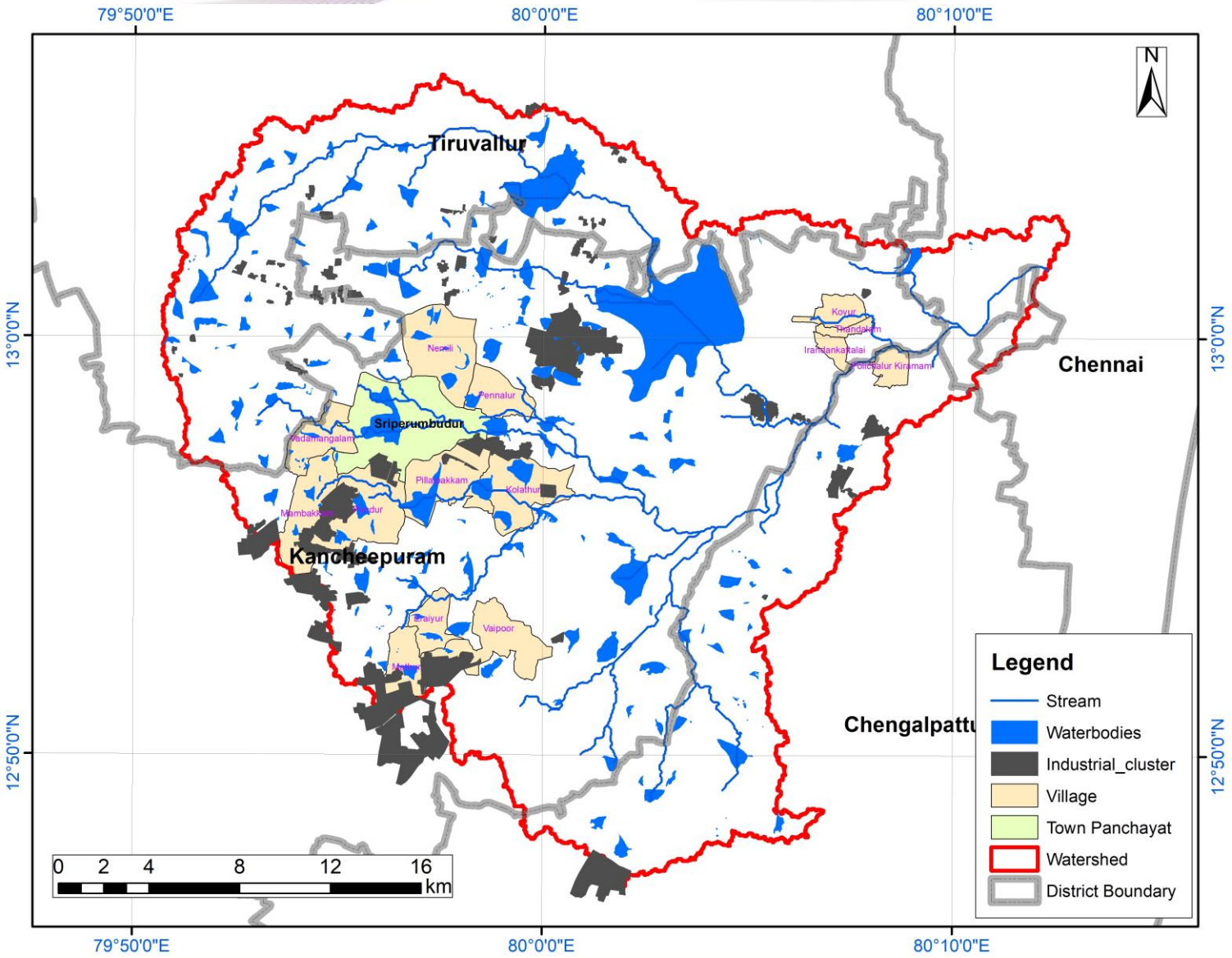
Marginal Water Gap Areas: -0.05 mm/ha to 0.13 mm/ha

Positive Water Gap Areas: 0.13mm/ha to 13.97 mm/ha

3.4 Water Gap Assessment



3.5 Identification of villages for surveys



Priority Villages	
Nemili	✓
Pennalur	✓
Kolathur	✓
Pillaipakkam	✓
Pondur	✓
Mambakkam	✓
Vadamangalam	✓
Mathur	✓
Eraiyur	✓
Vaipoor	✓
Kovur	✓
Thandalam	
Irandankattalai	
Polichalur Kiramam	✓

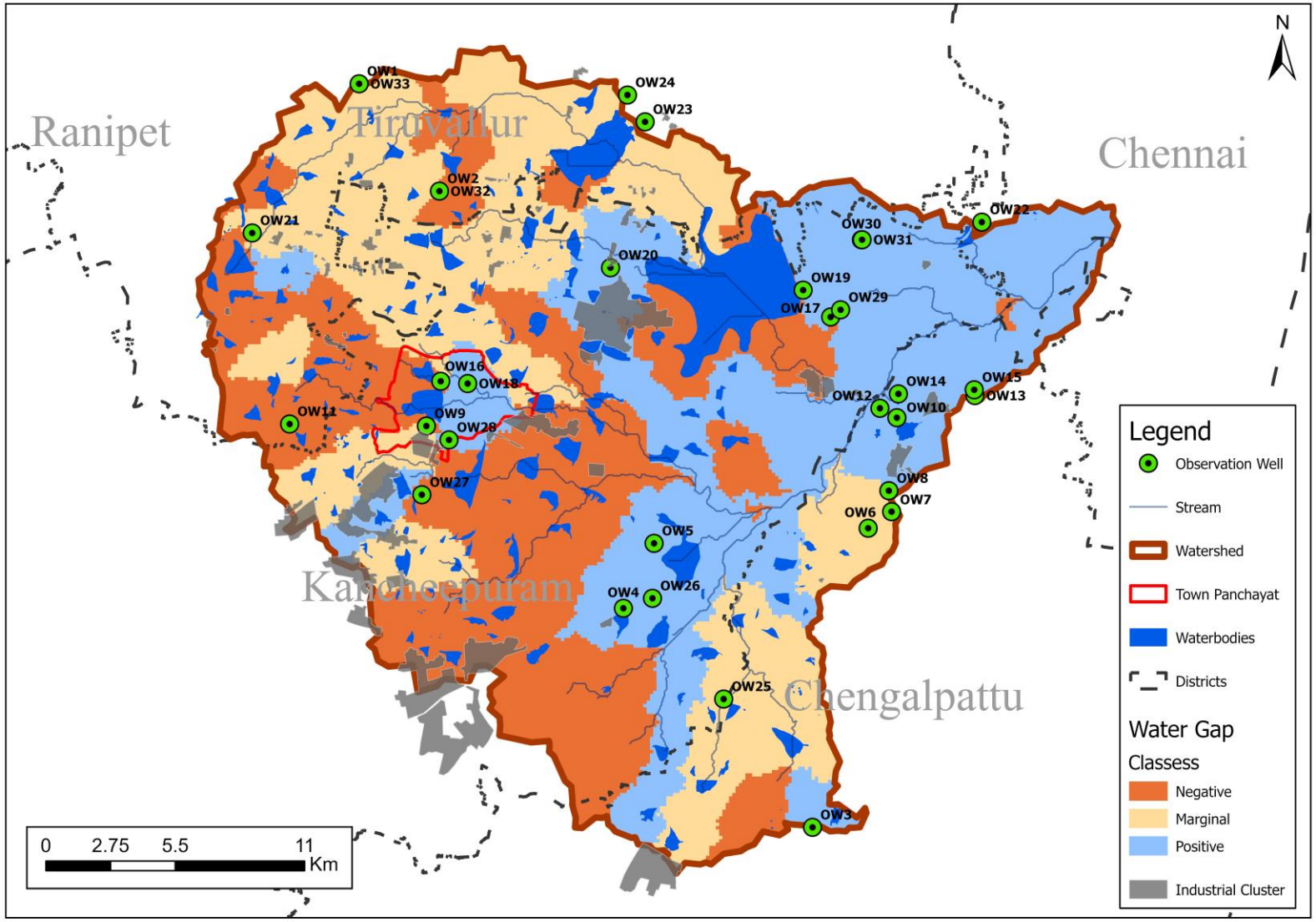
Legend

Up-stream Villages
Downstream Villages
Around Sriperumbudur

4. Village Surveys – Validation and ground truthing

- Insights based on primary data analysis
- Validation of outcomes

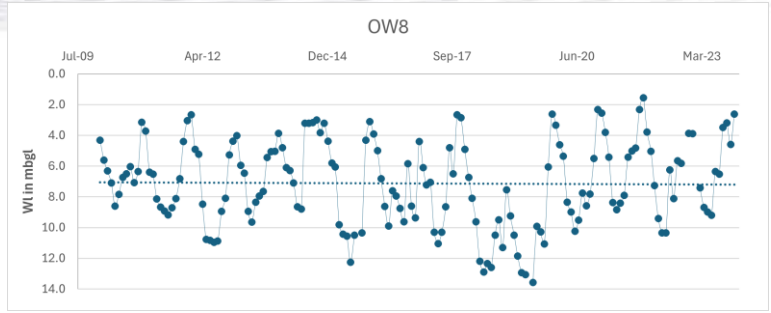
4.1a Groundwater Monitoring Wells in the watershed

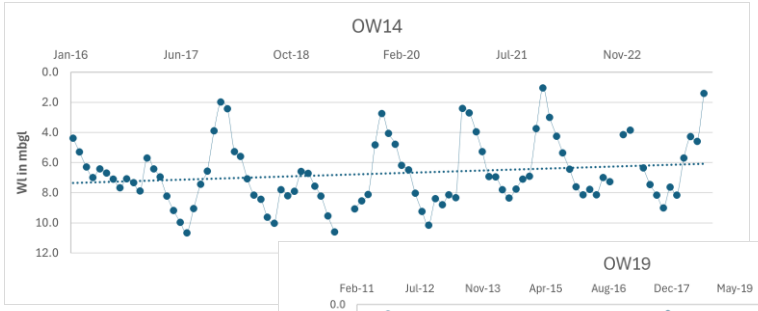


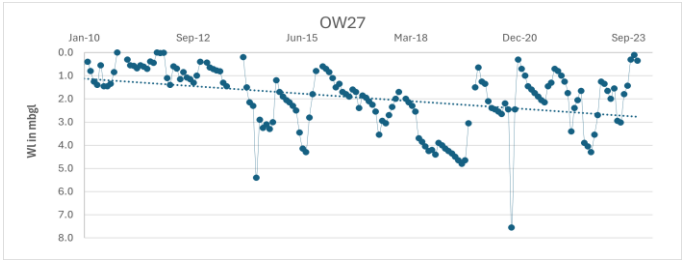
Data from 33 observation wells lying within the watershed was collected for assessing groundwater trends over time.

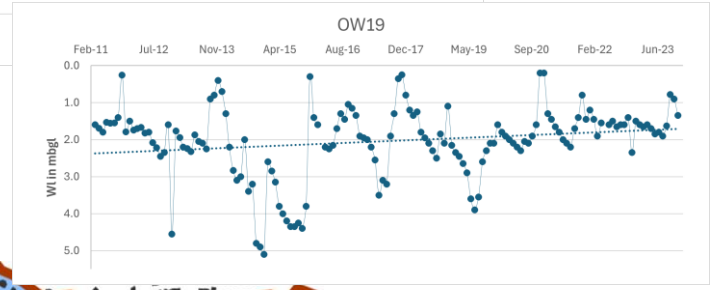
Data Source: State Ground and Surface Water Resources Data Centre, Tharamani, Chennai

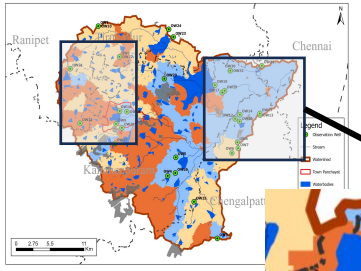
4.1b Groundwater wells in the watershed

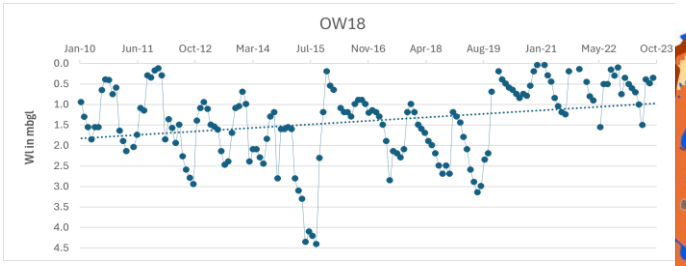


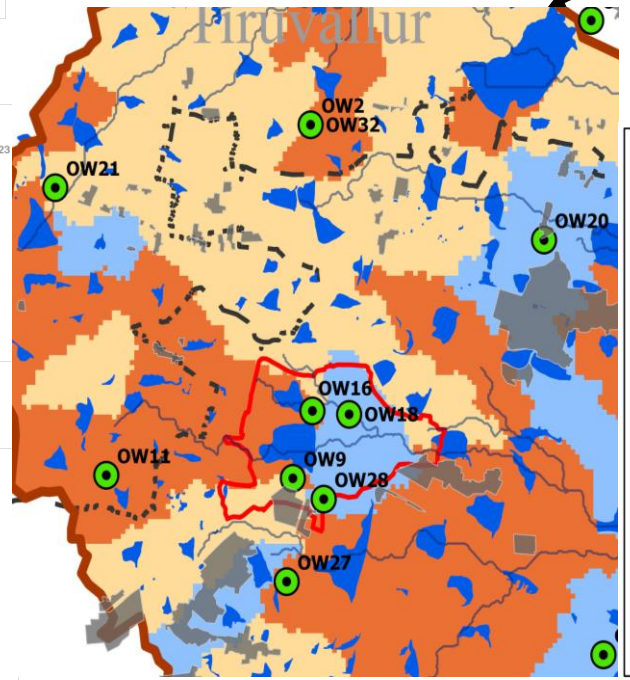


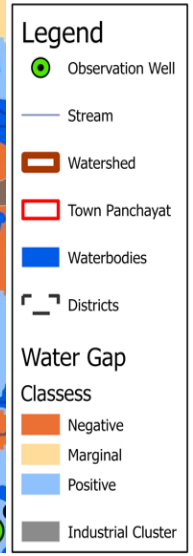


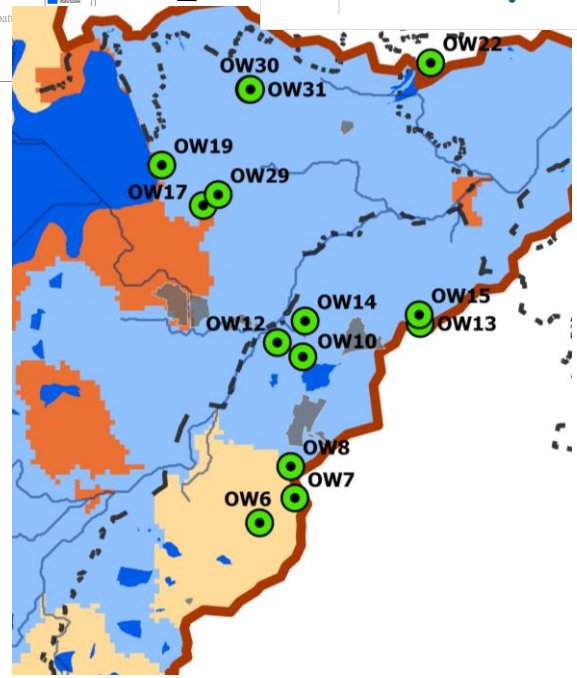


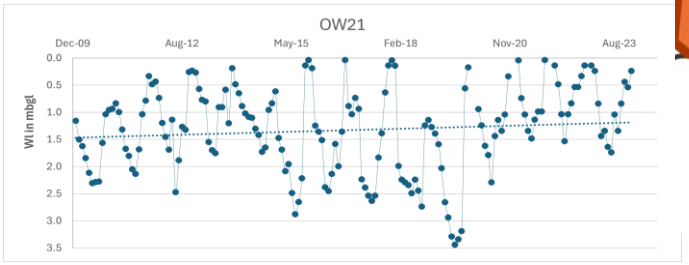












4.2 Findings from groundwater data analysis

Negative Water Gap Areas

- **Water resources are significantly stressed** (i.e. demand is more than the yields)
- **Conflicting demands** emerging between stakeholders
- Observation wells **showing declining groundwater levels**, (i.e., over-extraction or depletion).
- Areas are at **high risk of water scarcity,** require **urgent water management** & conservation measures.
- Water quality of water bodies – due to sectoral intensification and land use changes – would be impacted

Marginal Water Gap Areas

- Areas with a **marginal water gap**
- Observation wells in these areas **display fluctuating trends.**
- These areas, while not critically water stressed, are **vulnerable and likely to slip** to negative if timely interventions are not taken. **Water Use Efficiency measures** will be important determinant.

Positive Water Gap Areas

- **Water resource availability** (yields) is more than the demand.
- Observation wells, show stable or increasing groundwater levels
- These areas are less likely to face water scarcity in the near future but are prone to floods/ inundation as flood absorption capacity of these soils could be low.
- **Land use change (urbanization)** is high leading to high runoffs, sediments, and changes in components of hydrological cycle

4.3 Key findings from village FGDs

Social

- Agriculture is the primary occupation.
- 50% Marginal farmers (< 1ha),

Cropping Pattern

- 92% of respondents practice double cropping - growing paddy as both first and second crops,
- 8% of the farmers cultivate only paddy as their single crop.

Promote Sustainable Practices and Crop diversification

Irrigation

- 91% use surface water for irrigation (Tanks and Canals),
- 8.5% rely on groundwater,

Supply side management

1) Promote Micro Irrigation Methods (precision agriculture)
2) Water Resource Management: Implement strategies to balance reliance on surface water with sustainable practices

Soil Health

- 16% have done soil testing;
  - 2.5% received soil health cards.
- Predominant use of Chemical fertilizers
- 76% use pesticides.

Water Use Efficiency

- 2% of the respondents use sprinkler or drip irrigation systems, (Villages - Kolathur and Pillaipakkam)

Demand side management strategies to be adopted

1) Promote Efficient Irrigation Technologies with educational campaigns, exposure visits.
2) Expand Infrastructure and Support: increase availability of irrigation infrastructure and technical support in areas where adoption is low.

Water Quality

- 76.5% of respondents reported issues with irrigation water quality, including turbidity and unpleasant smell

Water Health linkages need to studied

1) Invest in Water Quality Assessment
2) Implement Water Treatment Solutions: Based on the findings from the water quality assessments, consider investing in appropriate water treatment technologies
3) Monitor and Evaluate: water quality over time.

5. Water Allocations

- Definition, Principles and Framework

5.1 Water Allocation

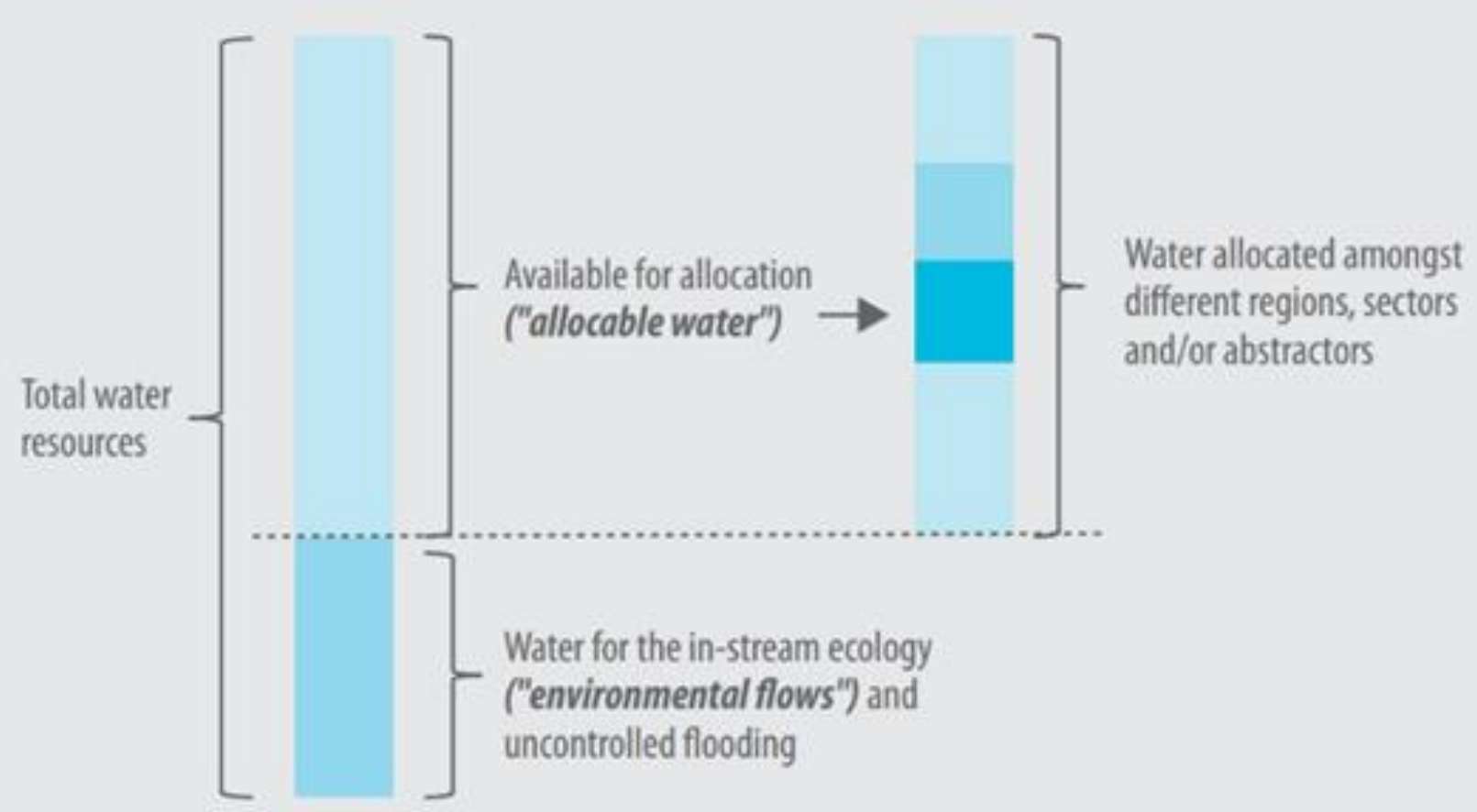
Water allocation is the combination of actions which **enable water users** and **water uses** to take or to receive water for beneficial purposes according to a recognized system of rights and priorities (UNESCAP, 2000).

*Allocation limits are set by considering **scientific information** (such as hydrological flows, recharge and ecological water needs) and then balancing this against use information, such **as current and future water demand**.*

Principle for Allocation Planning

- Water resources are shared public resource that need to be managed sustainably & equitably. This means that, all water users have a right to access water resources in a manner that balances their needs with the needs of the environment & the community.

5.2 Water Allocation Framework



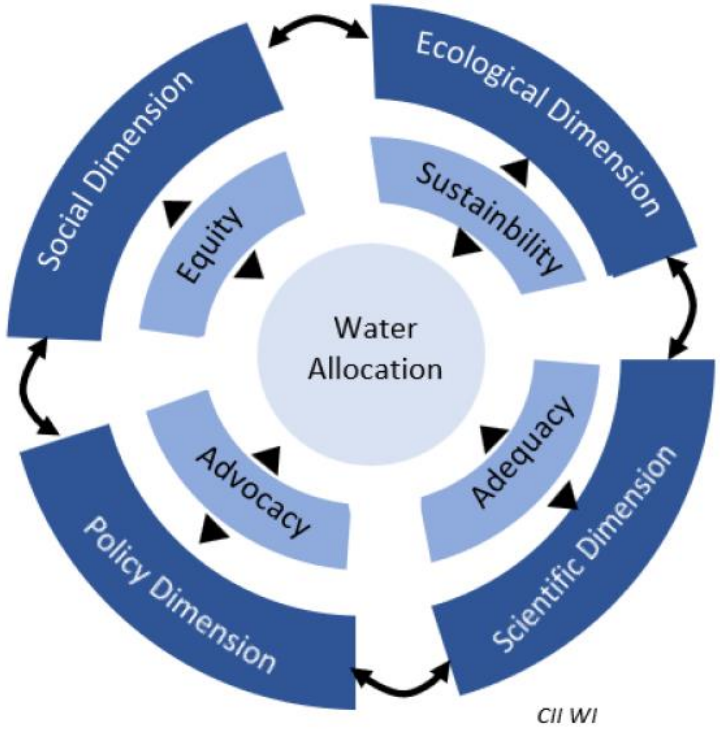
The framework outlines how water is to be shared between:

- **consumptive uses**, like industry, domestic, and agriculture
- **non-consumptive uses**, like environmental or cultural uses.

Source: R. Speed, Li Y., T.Le Quesne, G.Pegram and Z.Zhiwei (2013) Basin Water Allocation Planning. Principles, procedures and approached for basin allocation planning, UNESCO, Paris.

5.3 Principles

1. **Sustainability**: ensuring water use supports long-term ecosystem & resource health.
2. **Equity**: promoting fair distribution of water resources among all stakeholders.
3. **Adequacy**: ensuring there is enough water to meet the needs of different sectors & communities.
4. **Advocacy**: balance competing demands, protect ecosystems, and ensure water is managed as a shared and sustainable resource for all.



1. **Ecological Dimension** –environmental impact and the role of ecosystems in water management.
2. **Social Dimension** –societal aspects, ensuring, benefits communities equitably.
3. **Policy Dimension** –regulatory frameworks and governance required to manage water resources effectively.
4. **Scientific Dimension** data, research, and technical understanding for sound water management practices.

5.4 Water Allocation Plan

Step 1 → Step 2 → Step 3

Water Resource Evaluation

Explains water resource availability, its use and thereby assessing the prevailing water demand-availability gap for the specified watershed.

WATSCAN

✓✓

Water Allocation Framework

Sets the following

1. Water management zones,
2. Purpose and objectives of water allocation,
3. Estimate sustainable yield,
4. Allocation to beneficial uses within the estimated sustainable yield, and maps of the district/ plan area.

✓

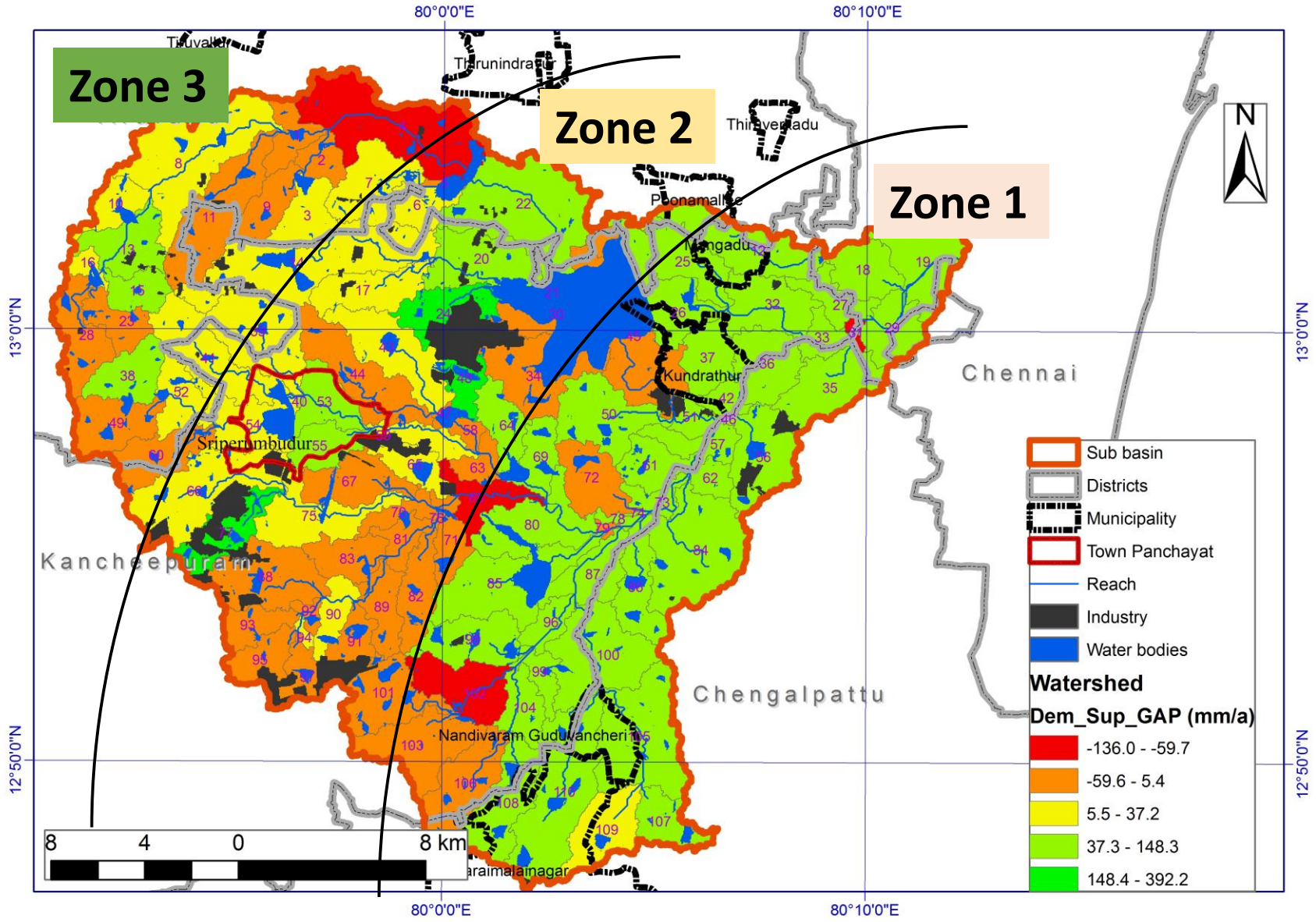
Implementation Actions

Outlines goals for defined allocations and how progress will be reported. Includes monitoring resource (spatially & temporally) with performance indicators - who's responsible for what.

6. Water Allocation Framework for Sriperumbudur

- Outcomes and Way Forward

6.1 Allocation Zones

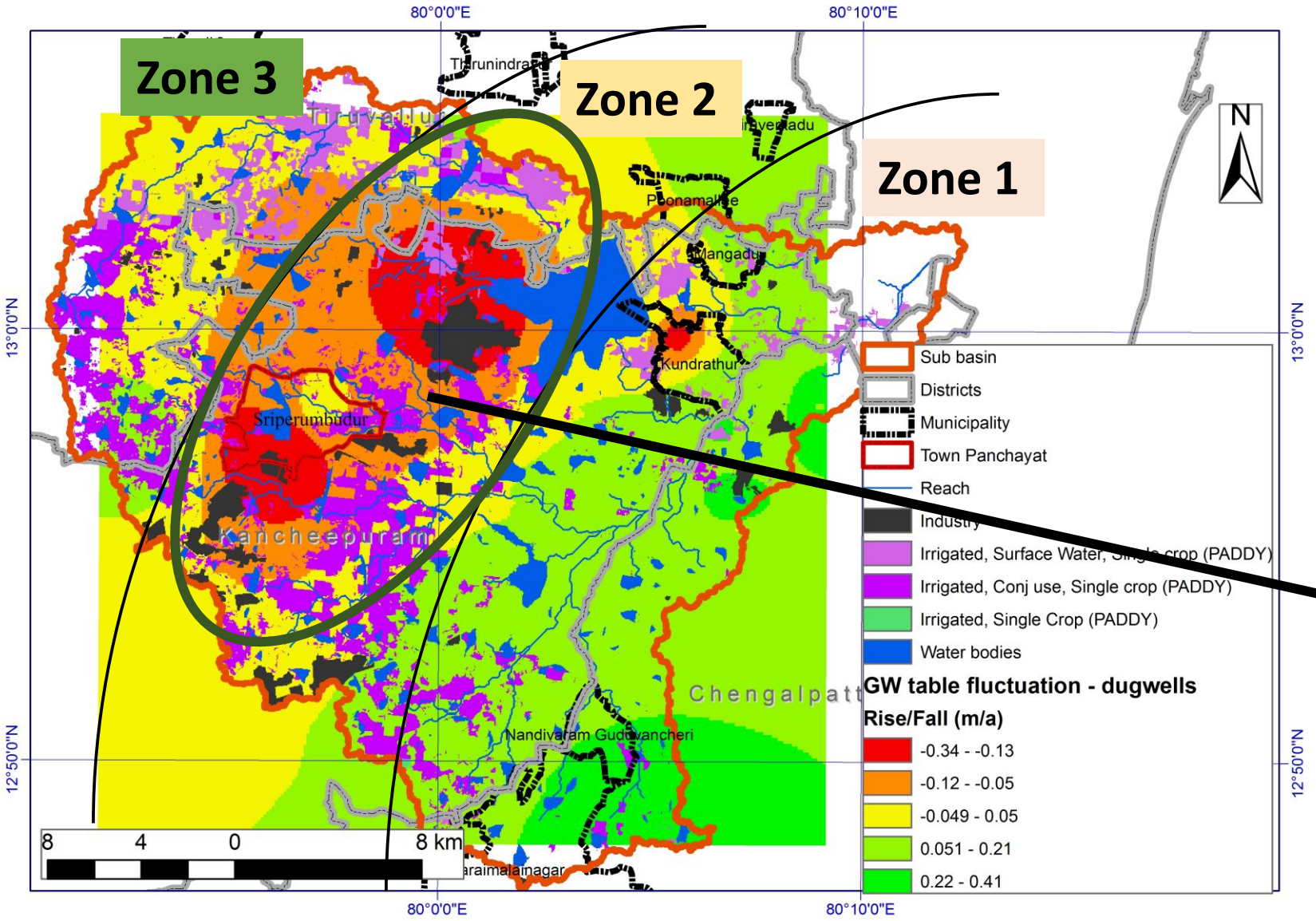


Zone 1:
Predominantly Built-up area

Zone 2:
Mix land use Industry, Agriculture (rangelands, barren area)

Zone 3:
Predominantly Agriculture area

6.2 Groundwater verification

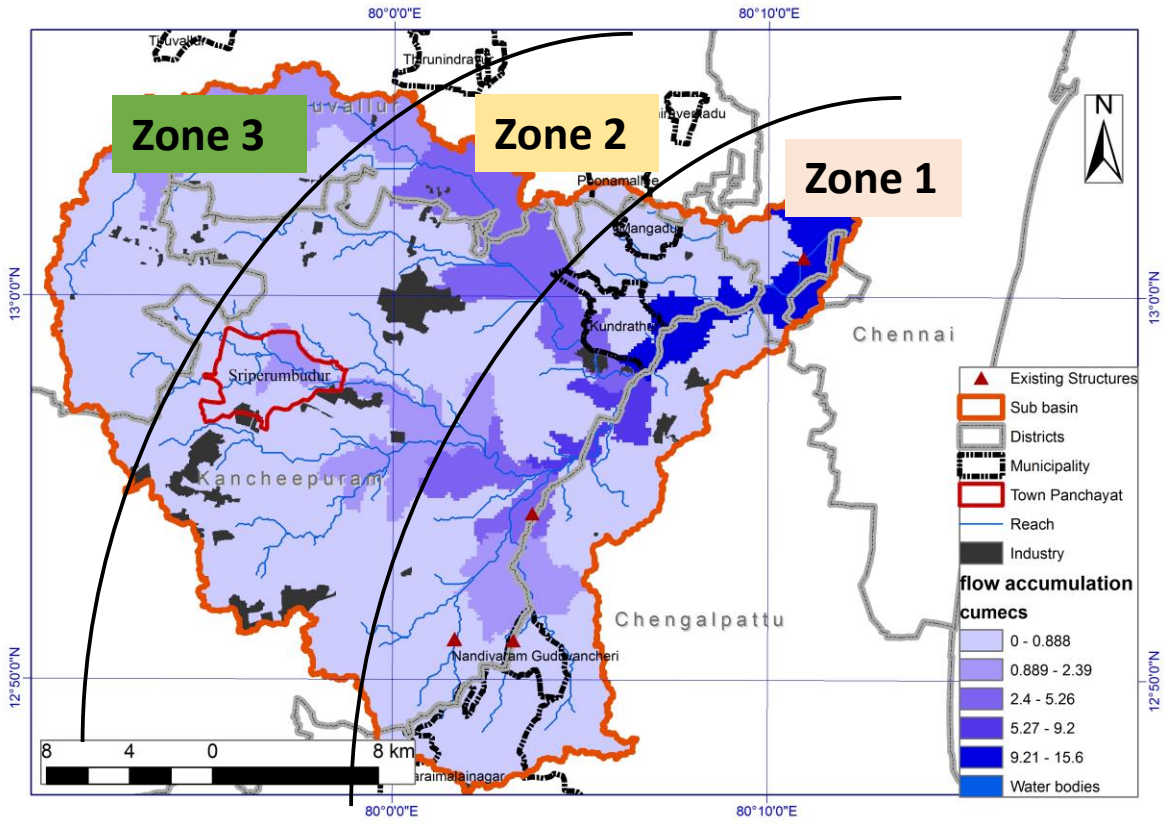


Indicator for verification : Groundwater Fluctuation (Rate of rise and fall, m/a)

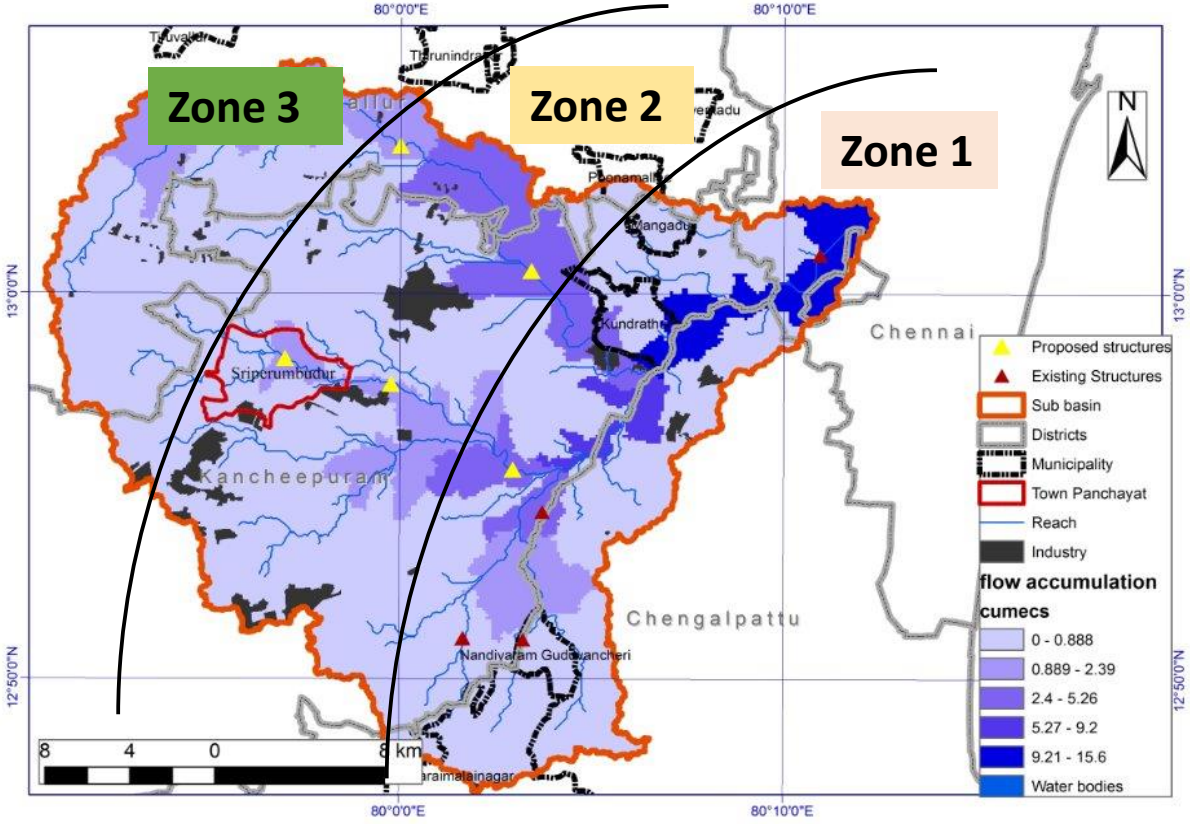
Zone showing high groundwater fluctuations. Competing use for a finite resource on a rise.

6.3 Suggestive Locations - Interventions

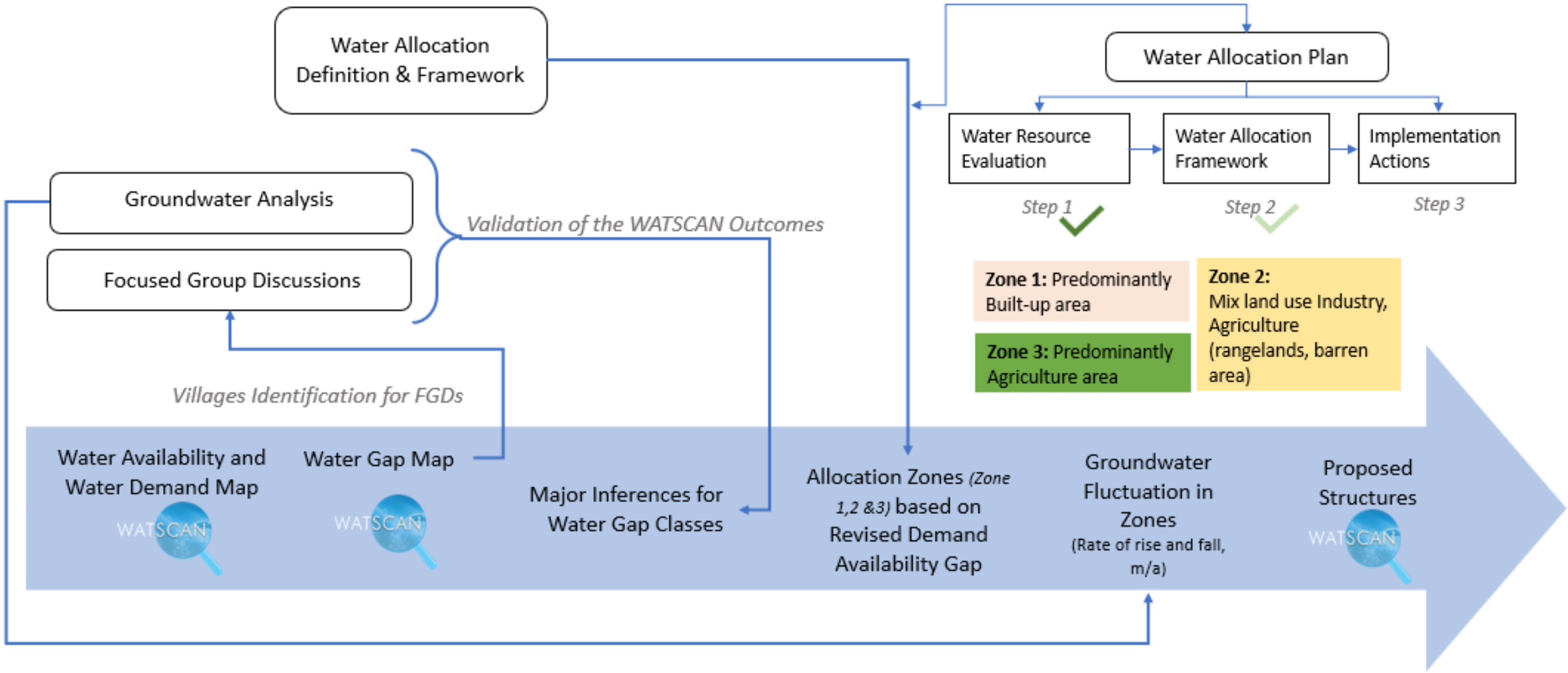
Existing Structures



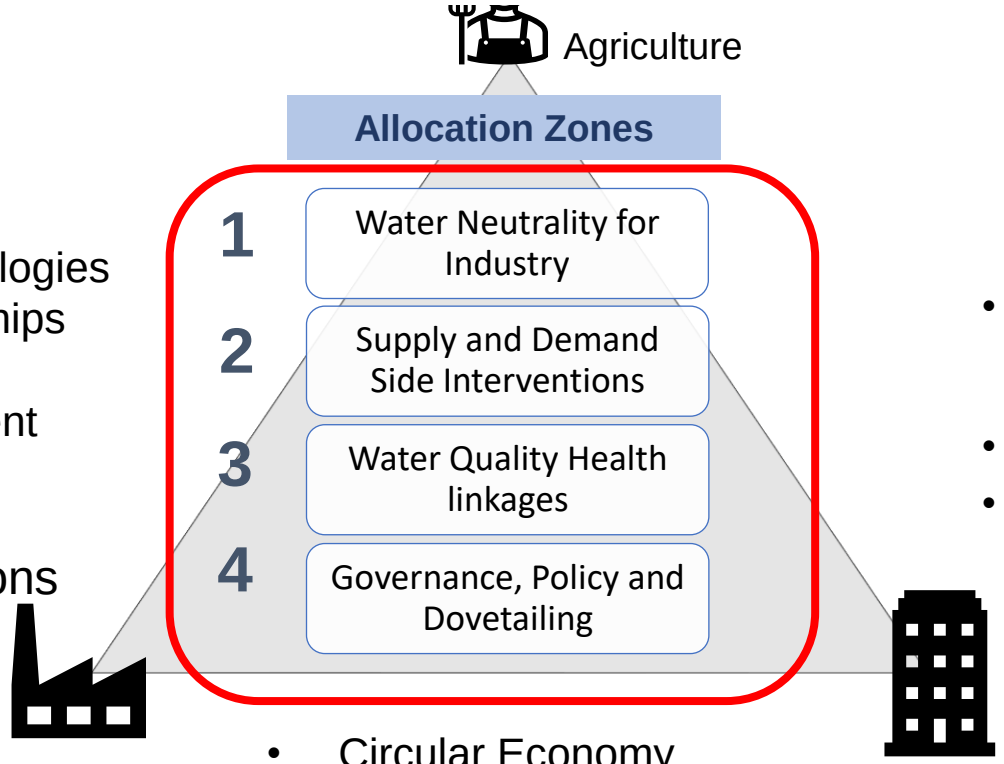
Proposed Structures



6.4 Overall Approach: Summary



6.5 Way Forward: Collective Action for Water Security



- Water-Efficient Technologies
- Agri-Industry Partnerships
- Wastewater Reuse
- Watershed Management
- Training Programs
- Climate Resilience
- Nature Based Solutions

- Water Management – Stable source of water for farmers – water infrastructure
- Waste Management
- Water Pollution Control

Industry as mobiliser for Integrated Water Sustainable Solution

- Circular Economy
- Water Recycling
- Water Infrastructure
- Water Pollution Control
- Climate Resilience

Collaborative watershed management initiatives led by multiple industries aim to optimize water allocation, enhance livelihoods, and promote sustainable development in the region.

Thank You

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For more information, Contact:

Ms Aditi Haksar
Head - Projects
CII – Water Institute
Confederation of Indian Industry
E – Aditi.Haksar@cii.in
M : 88260 57341