

# Characterizing Tap-to-Household Water Recontamination: Method Development for Regions with Limited Data Availability

## Introduction

It is estimated that 4 billion cases of diarrheal disease occur globally each year. The World Health Organization approximates that environmental and meteorological factors contribute to 94% of these cases. Characterizing risk factors that influence the rate of diarrheal disease could lead to practical recommendations regarding the location and timing of interventions.

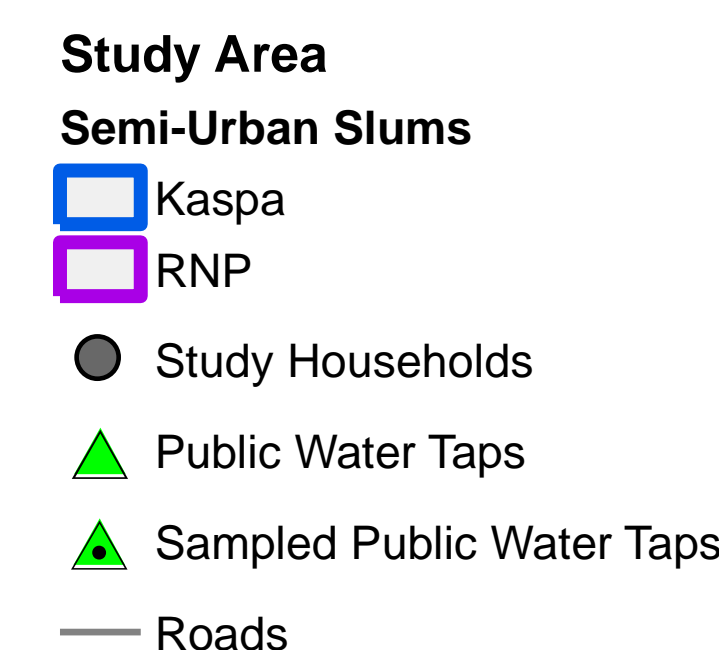
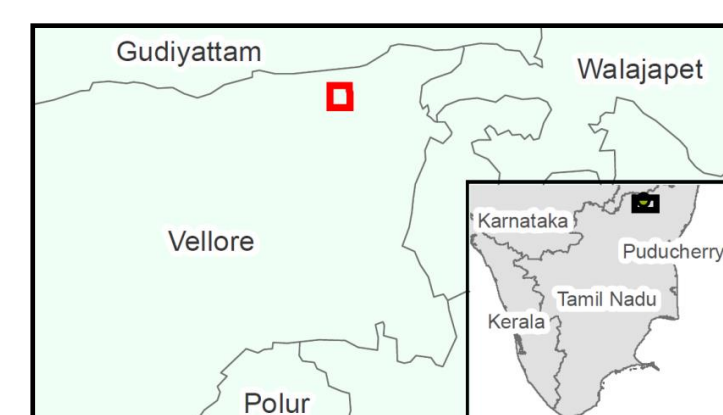
In developing countries, people often have to collect water from public taps, tanks, or water trucks. Even if the water quality at the source is adequate, there is a risk of contamination during transport, via piping or carrying containers, to each individual household. Extensive water quality monitoring between sources and households is usually not feasible, because of cost and privacy concerns. Thus, available water quality monitoring data tends to be limited in terms of temporal and spatial distribution. This project focuses on developing methods to characterize tap-to-household water recontamination in locations with limited data availability. The main goal of this project is to develop methods that will allow easy comparison of multiple spatial and temporal assumptions.

## Data

Water quality (pH, nitrate, TDS, total coliform, and fecal coliform) was monitored for 12 months in 160 study households and 60 public water taps in two urban slums in Vellore, Tamil Nadu, India. This data set is considered limited for a tap-to-household recontamination study because:

- weekly sample collection did not follow any spatial or temporal pattern, and
- it is unknown where households obtained their water.

These two limitations translate to assumptions regarding the spatial and temporal connection between water quality at the tap and at the household.

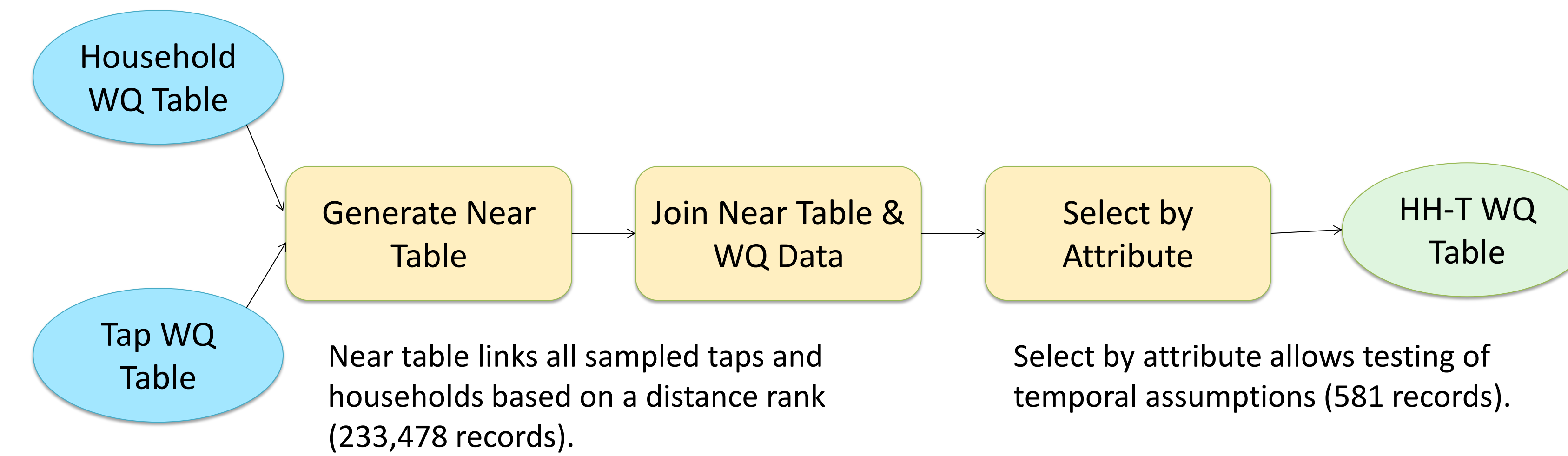


## Methods

### 1. Link Tap and Household Data based on Temporal Assumptions

Temporal assumption: link only taps and households sampled on the same day.

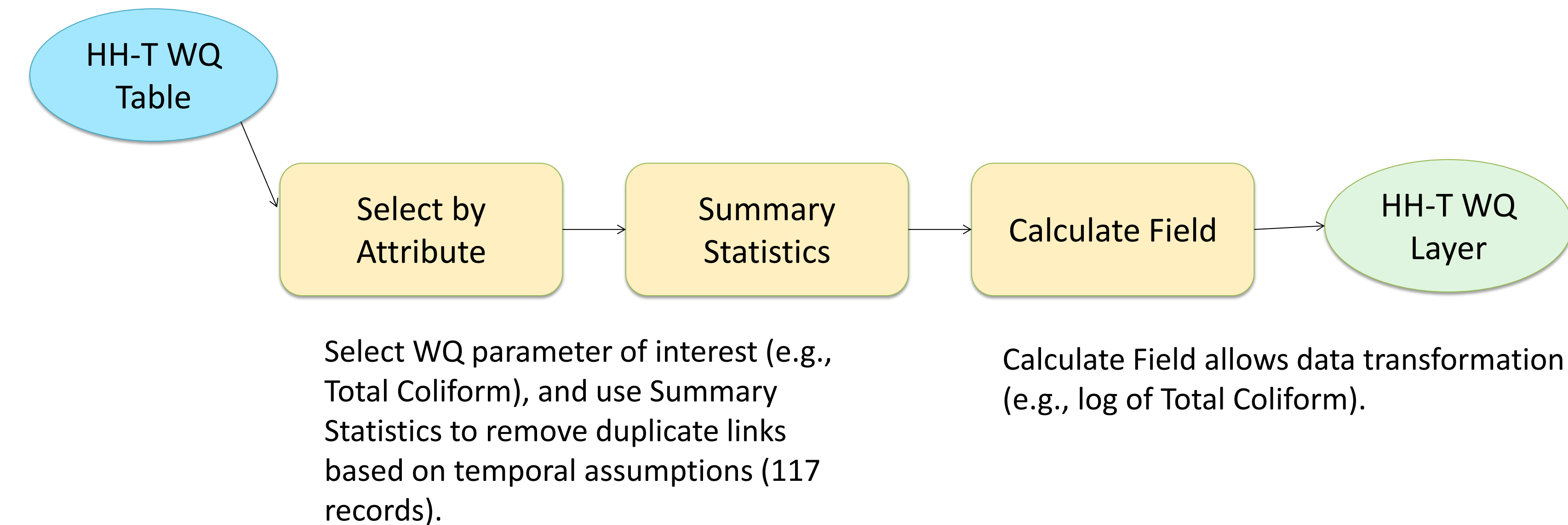
Save as Tool in GIS as *RecontTempAssump*.



### 2. Generate GIS Layer based on Spatial Assumptions

Spatial assumption: if duplicate links exist, select only the link with the shortest linear distance between household and tap.

Save as Tool in GIS as *RecontSpatialAssump*.

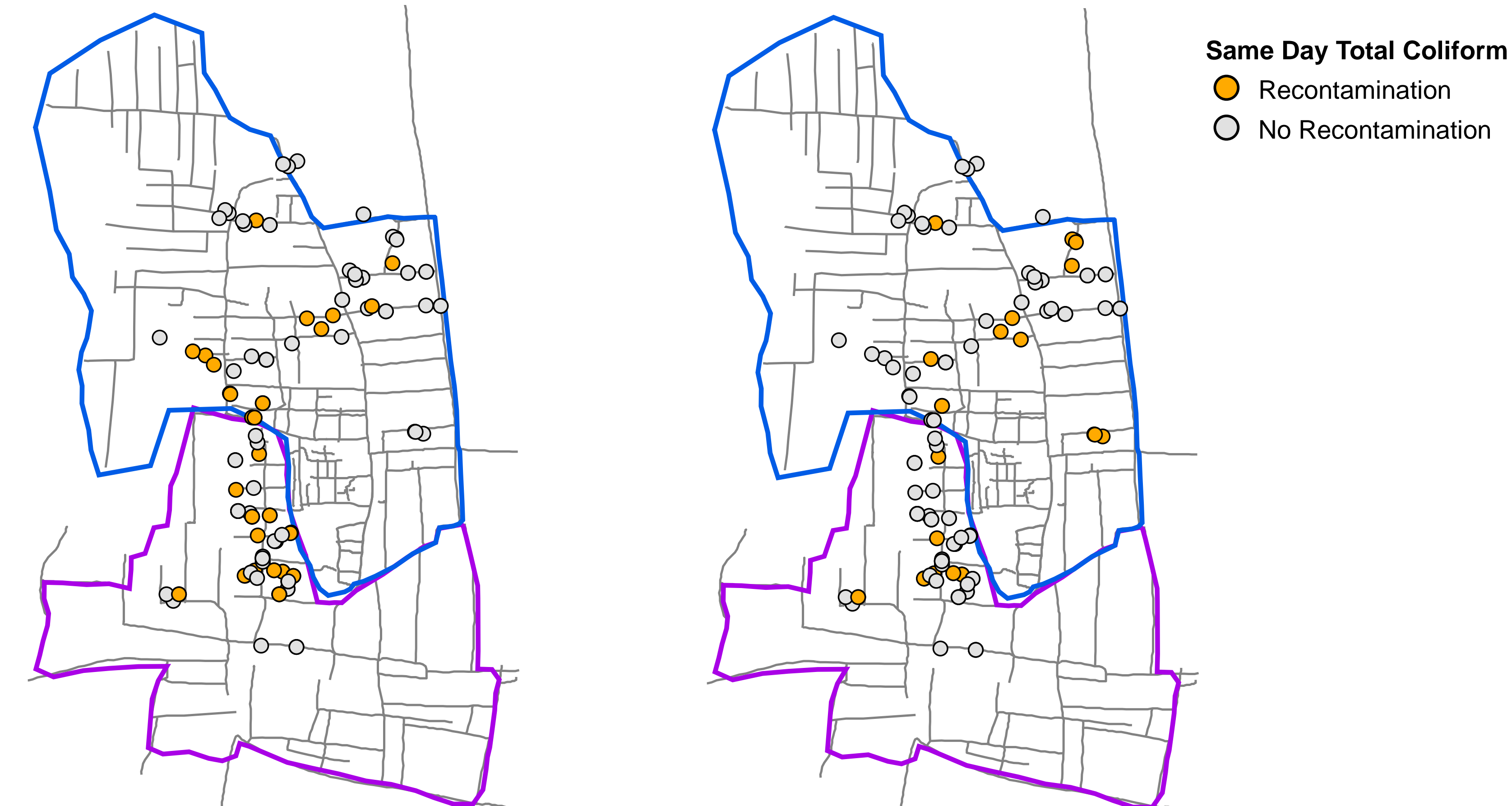


## Results

WQ parameter: Total Coliform. Temporal Assumption: same day Tap-Household sampling. Spatial assumption:

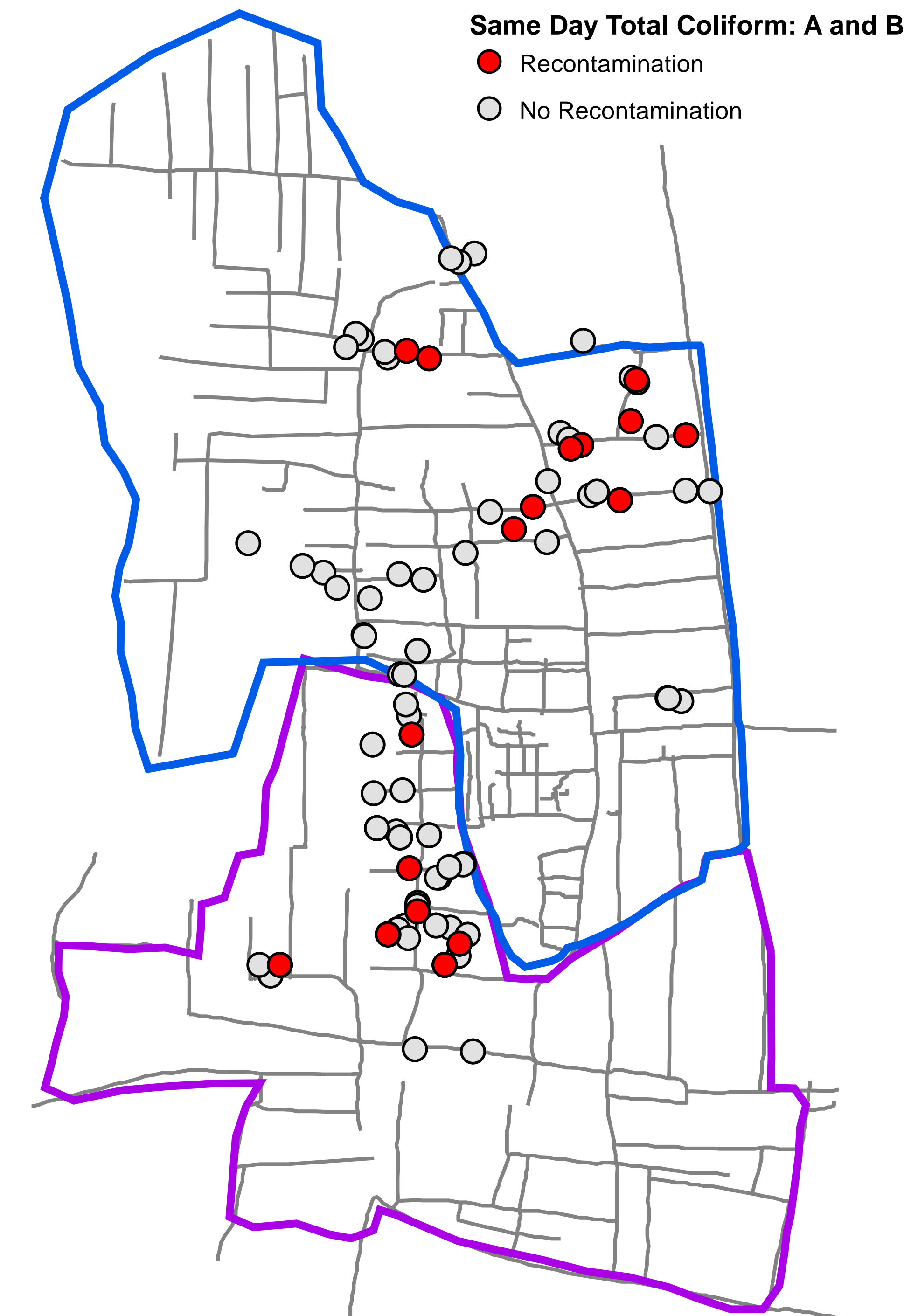
**A) shortest Tap-Household distance**

**B) longest Tap-Household distance**



## Conclusions

Spatial and temporal assumptions affect Total Coliform recontamination patterns seen in this study area. Based on the assumption of shortest distance, 36% of the records showed recontamination compared to 28% for the longest distance assumption. If the shortest and longest distance maps are joined spatially, only 17% of samples show recontamination.



The tools developed in this project can be used to generate multiple GIS layers based on temporal and spatial assumptions. Those layers can then be combined to show recontamination locations regardless of temporal and spatial assumptions.

## Cartography and Poster Design

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Projection: Transverse Mercator (WGS 1984 UTM Zone 44N)  
Data Sources:  
Vellore Project GIS Data [USB flash drive] Medford, Massachusetts: Alexandra Kulinkina, 2014  
GADM database of Global Administrative Areas, Version 2.0. [online database]. (2012) Available: <http://www.gadm.org/county> [September 28, 2014]