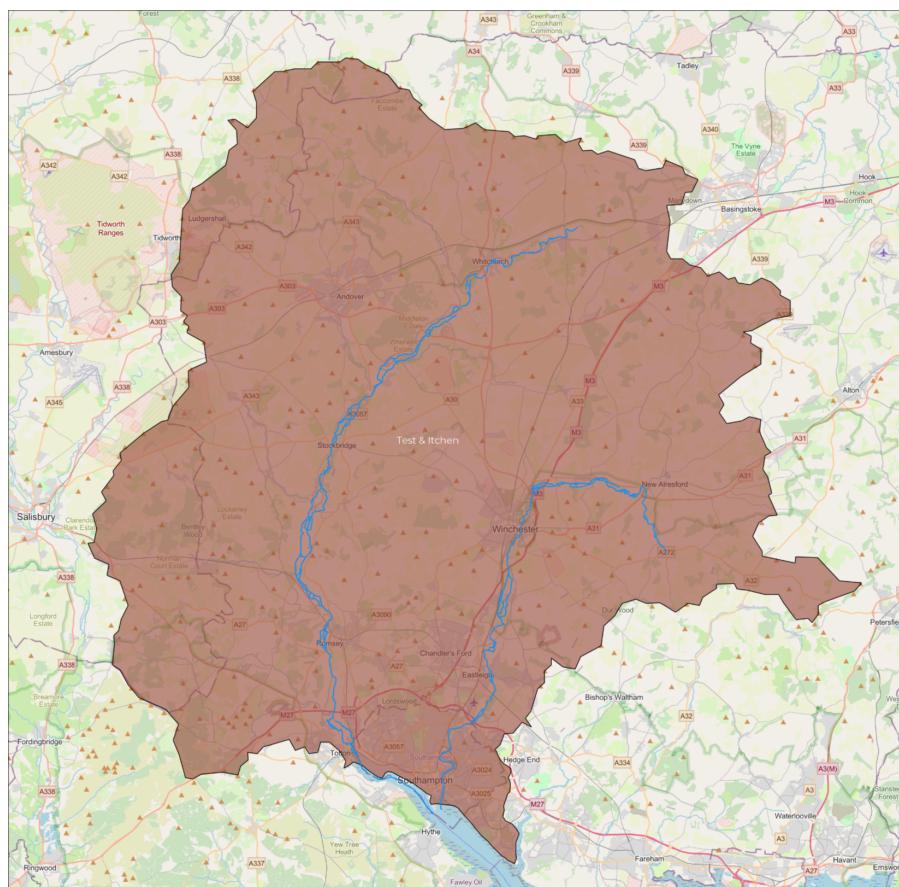


## Report part 1: Background Information

This essay sets out to provide five recommendations to *regional governance* on improving water security in the Test and Itchen Management Catchment. It investigates the management catchment for key stakeholders that must be considered in making recommendations, the system and subsystems at play in the region and their interactions, what lessons can be learnt from the current initiatives to improve water security, any knock on effects from interventions, and views the recommendations through a net-zero lens to assess their environmental impact.

The United Kingdom's Department for Environment, Food & Rural Affairs (DEFRA) has divided England into ten River Basin districts, generally relating to their geographical location. One of these is the South East district, which itself has 12 Management Catchments defined within it[1]. This way of dividing England's water supply is the result of the Catchment Based Approach[2], enabling on "locally focussed decision making and action," supporting existing river basin management planning. This approach defines a catchment as "A geographic area defined naturally by surface water hydrology.[W]e have adopted the definition of Management Catchments that the Environment Agency uses..."

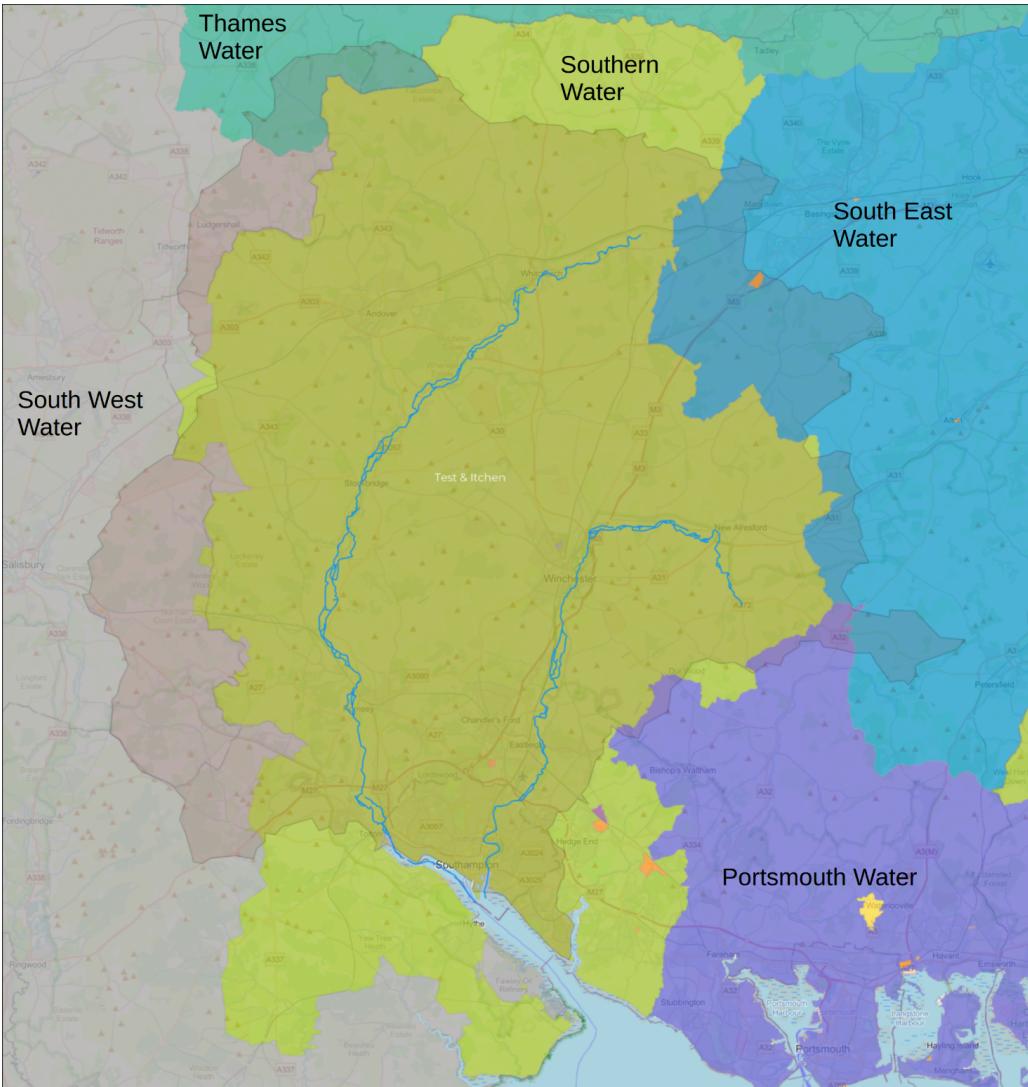
One of these management catchments is the Test and Itchen Management Catchment, defined by the Environment Agency for water abstraction licensing[3] as the catchments of both the River Test and the River Itchen in Hampshire (see figure 1). The management catchment is predominantly rural, comprising around  $1760\text{ km}^2$  of Hampshire. The Test and Itchen are chalk streams, drawing flow from the groundwater along the northern section of the management catchment.[4] Both of the rivers have been declared Sites of Special Scientific Interest (SSSI) for their biodiversity[5][6], and the Itchen has been declared a Special Area of Conservation (SAC) for the presence of rare fauna [7]. The River Test runs from its source in Ashe to Southampton Water where it meets the Solent, flowing to the west of Southampton. The River Itchen runs from its source south of New Alresford to Southampton Water, flowing to the east of Southampton.



**Figure 1:** Map of the Test and Itchen Management Catchment[8].

The rivers serve as a major source of public water for Hampshire, with water being distributed throughout

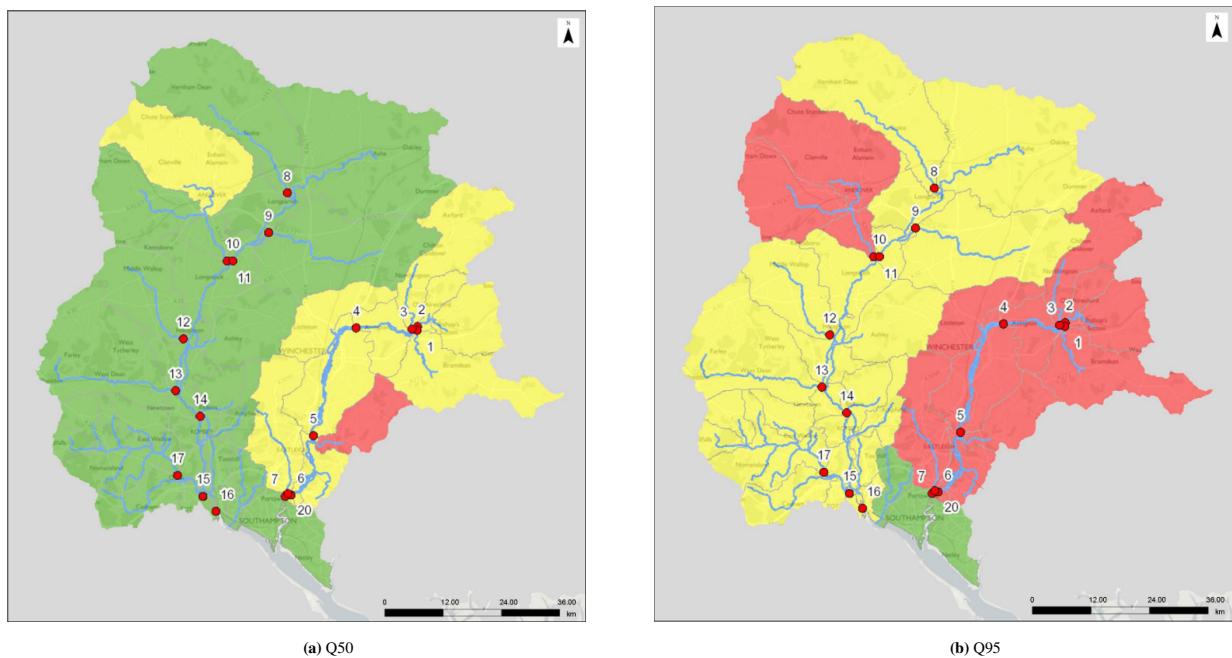
the management catchment as well as to other parts of Hampshire and to the Isle of Wight[4]. The majority of public water in the area is supplied by Southern Water with small sections of the management catchment being served by South West Water, Wessex Water, Thames Water, and South East Water[9] (see figure 2). Additionally, the management catchment encompasses four large settlements: The cities of Southampton and Winchester, and the Towns of Andover and Eastleigh.



**Figure 2:** Map of the Test and Itchen Management Catchment, with Water Company shown [8].

Water availability and reliability in the Management Catchment are reported in the Environment Agency's Abstraction Licensing Strategy (ALS)[3], which dictates where individuals and organisations are granted licenses to abstract water from the rivers or groundwater. It shows that from 18 test points along the Test and Itchen that 50% (Q50) of the time, water is available in the majority of the catchment along the Test, but that along most of the Itchen and in Andover only restricted water is available (see figure 3a). Across the whole catchment worsens to no water available along the Itchen and in Andover, and restricted water available along the rest of the Test when the flow is at levels exceeded 95% of the time (Q95)(see figure 3b). This has resulted in water being unavailable for licensing along the Itchen in its entirety, and restricted water available for licensing along the Test. Additionally, the abstraction licenses held by Portsmouth Water and Southern Water were reviewed in 2011 and 2019 respectively to improve availability along the Itchen. In Southern Water's case, a "Reduction in annual and daily quantity" was made. Additionally, conditions on minimum flow through Environment Agency gauging stations have been introduced, with the minimum flow increasing for 10 months of the year from 2027[10]

Since



**Figure 3:** Water resource availability colours at Q50 and Q95 for Test and Itchen ALS. Green: Water Available; Yellow: Restricted Water Available; Red: No Water Available.[3]

## **Report part 2: Assumptions**

The following assumptions are made in the analysis to bound the problem space:

1. It is assumed that the needs and impacts of the various independant water companies that operate in the management catchment area, or otherwise abstract water from the Rivers Test and Itchen, are negligible compared to that of Southern Water and Portsmouth Water
2. It is assumed that the needs of areas outside of the management catchment (e.g. the Isle of Wight) remain static and can be modelled as constants.
3. It is assumed that stakeholders respect local authorities, regulators, and other organisations
4. It is assumed that shareholders in public water companies would not unreasonably withhold funding from them, and are not operating these companies illegally
5. The debt held by public water companies is ignored

## **Report part 3a: Criteria for Method Selection**

1. Worldview - Positivist or Constructivist?
2. Data availability
3. Accessibility - of method
4. Output Relevance - Not just question but general insight
5. Question Relevance - Does this answer the question?
6. Development - Does it develop output of another method?
7. Facilitaiton - Does it enable another method?
8. Supporting Literature - Is it backed up?
9. Maturity - Is it established?
10. Flexibility - Can I make it fit?
11. Redundance - Is it already covered?

## **Report part 3b: Method Selection**

- Rich Picture
- Pig Diagram
- CATWOE
- Systemigram
- CLD
- System Dynamics
- Iceberg Model
- $N^2$
- Cynefin
- RMF
- HTA
- Accimap
- EAST-BL
- SPTA
- VSM

## **Report part 4: Application of methods and recommendations**

To produce the five recommendations, this paper considers six research questions whose answers will inform the recommendations.

1. What key stakeholders are in the Test and Itchen Management Catchment, and what are their worldviews?
2. What subsystems are present in the system, and how do they interact with each other?
3. What elements of the system are most sensitive to intervention?
4. How effective are current initiatives at improving water security, and what can be learnt from them?
5. What negative consequences are likely from interventions in sensitive areas?
6. What are the greenhouse gas emitters in the system and in current initiatives, and how can they be mitigated?

## **Report part 5: Ethics**

## **Report part 6: Statement of Quality**

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