Operational Value of Inlet Monitoring at Service Reservoirs.

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Stream

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Introduction

Drinking water quality leaving water treatment works (WTW's) is of a consistently high standard, yet it degrades leading to reported failures as it makes its way through the different assets that form distribution systems (Figure 1). Deterioration can be related to the condition of assets or how they are operated and it is therefore important to understand component performance to identify risk sources and optimise maintenance practices. In the UK, water quality is monitored in the network to account for this, including regulatory sampling at outlets of service reservoirs (Figure 2), where bacteriological failures can be double the rates at WTW's [1]. However, without inlet sampling, the results from outlet sampling alone do not confirm if issues are linked to the network between treatment and the service reservoir, the service reservoir itself, or both.

To investigate the water quality performance of service reservoirs and the upstream network, a nationally coordinated project with multiple water companies, and test sites, has been established to facilitate study and comparison across different configurations and conditions. The project will monitor changes and assess operational impacts in determinants including metal concentrations, turbidity and chlorine as drinking water is transported from the WTW, through distribution, and critically at the inlet and outlet of service reservoirs.

Methods

A sampling regime has been established across multiple UK water company distribution systems including service reservoirs and supplying WTW's. The regime incorporates standard weekly sampling for metals (iron and manganese), temperature, pH, and colony counts, as well as high temporal online turbidity and chlorine monitoring.

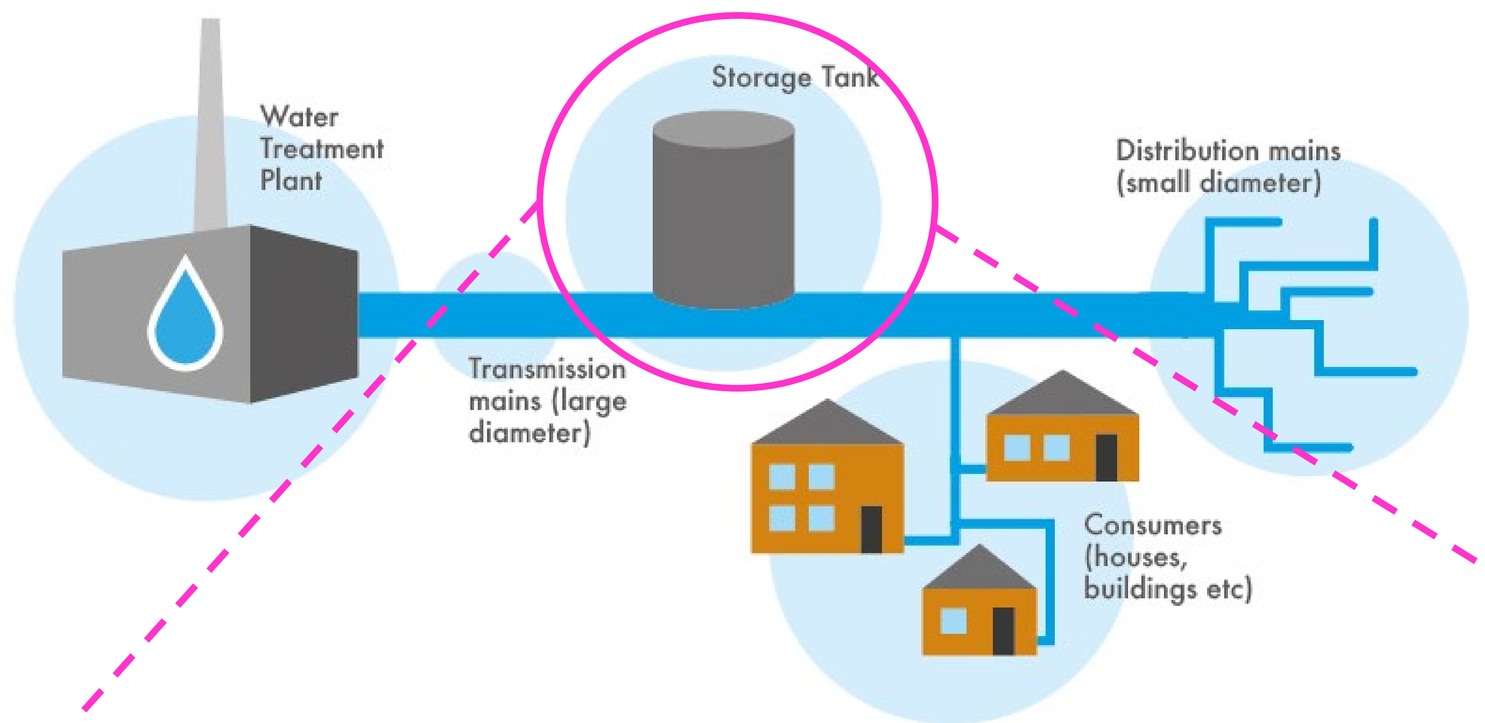

Figure 1 – *Classic layout of a distribution system.*

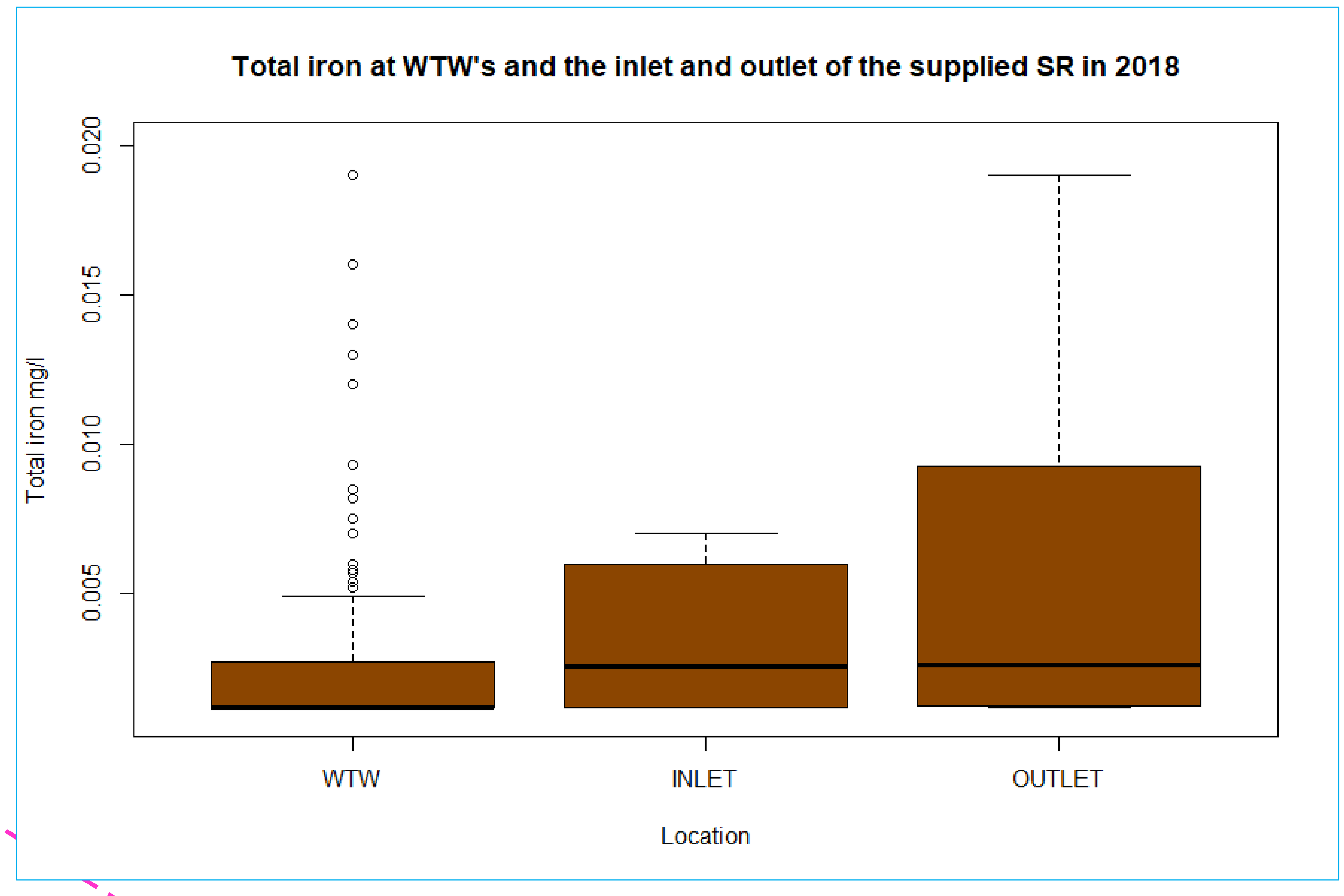

Figure 3 - *A box and whisker plot of total iron concentrations in mg/l at the outlet of water treatment works, and inlet and outlet of the supplied service reservoir across 2018 (typically taken weekly with n = 193). The SR is fed by 7.2km ductile and steel trunk mains and was last cleaned n 2012.*

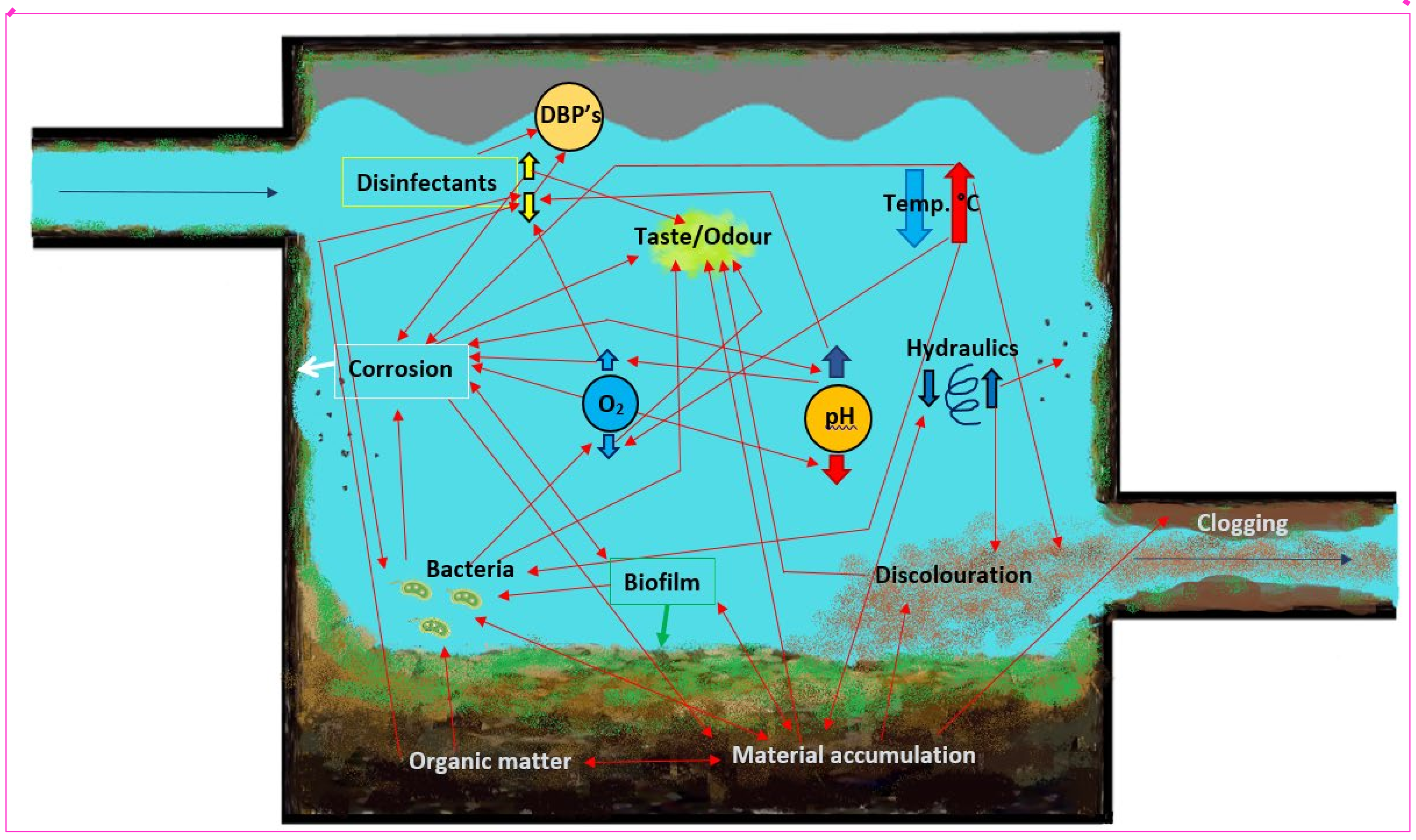

Figure 2 – *A diagram highlighting different interlinking chemical, physical, and biological parameters and processes in a service reservoir, demonstrating the value of water quality monitoring to detect changes in these assets.*

Results & Discussion

Main finding:

1. **Monitoring at the inlet of service reservoirs provides valuable information, helping the magnitude and location of network deterioration to be identified more accurately.**

Without inlet data (current practice), Figure 3 suggests the cause of the water quality deterioration is the service reservoir. With inlet data however, the same median concentration as the outlet, but greater data variability, it instead indicates deterioration occurs upstream of this asset, but its operation impacts output.

Findings specific to test site:

1. **Water quality deterioration is occurring in the trunk main.**
2. **There is instability in accumulated material in the service reservoir.**

Reference:
[1] Ellis, K. et al. 2018. Understanding the costs of investigating coliform and E. coli detections during routine drinking water quality monitoring. Urban Water Journal 15(2):101-108.

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