

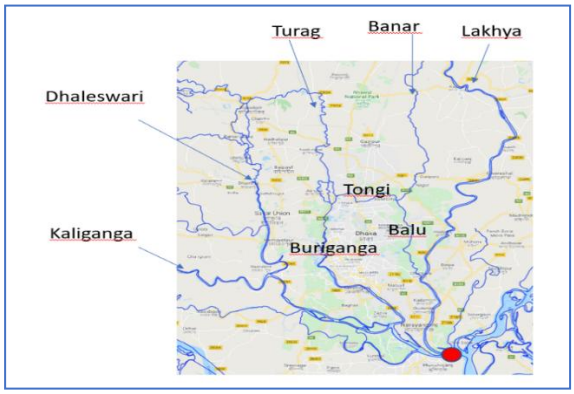
WRA Bulletin 80

November 2026

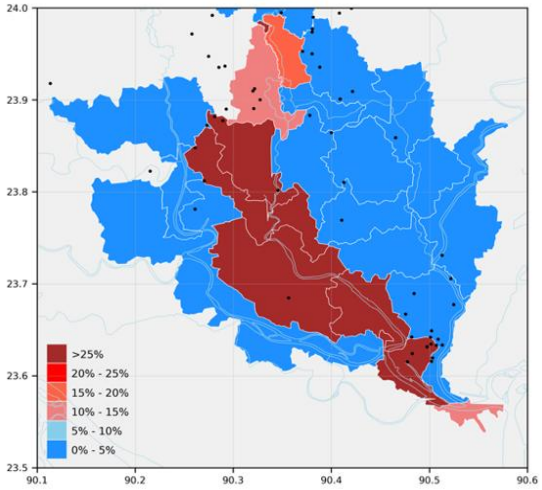
INTERNATIONAL WORK

Bangladesh River Modelling with Primark

As part of a contract with Primark, the INCA water quality models for flow, nutrients (Nitrate, Ammonia and Phosphorus), metals, DO/BOD and sediments have been used to assess the pollution impacts from Primark Suppliers. The models were applied to the complete river system network across the Dhaka area of Bangladesh. The current pollution loads and impacts were assessed as well as future pollution loading assuming growth by 2040s and climate change effects. The results were plotted spatially to give a view of the Primark factory impacts

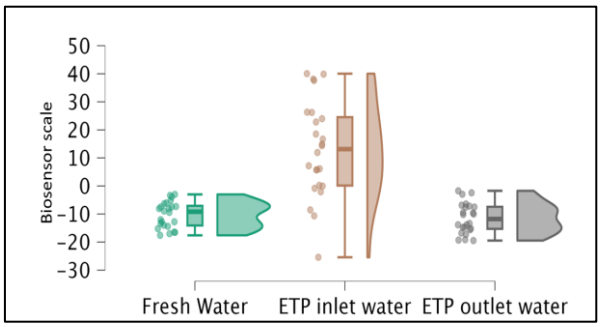


Map of the five rivers across the Dhaka Catchment



Spatial Patterns of Phosphorus in Dhaka Rivers

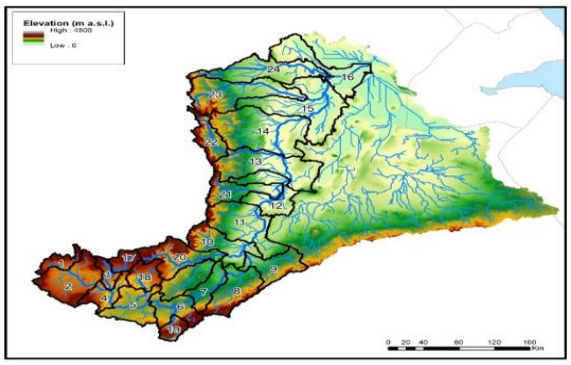
Working with Oxford Molecular Biosensors, we have evaluated the toxicity of the water from garment factory sites across Dhaka. The biosensors assess the damage to cell biology of living organisms and hence assess the potential ecological impacts on downstream rivers. The results show relative clean groundwaters used in the factories, the input to the treatment plant of highly toxic water waste from the factory and the outflows, indicating treated waters are much lower in toxicity and demonstrating efficient effluent treatment.



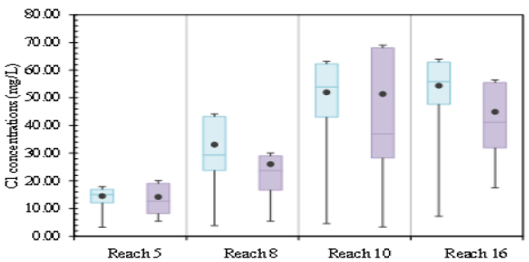
Biosensor Toxicity for Groundwater, Effluent and Treated Outlet Water

Ethiopia Heavy Metals Pollution and Toxicity

As part of the ongoing Oxford – WRA projects in Bangladesh and Ethiopia, WRA has evaluated the sources and sinks of salinity along the Awash River System. The Awash is a major water supply and agricultural irrigation catchment draining the city of Addis Ababa and flowing to the Djibouti Border. WRA used the Integrated Catchment Model (INCA) to simulate the salinity level (chloride concentration) in the Awash River Basin (including Lake Beseka) taking into account both natural and anthropogenic sources of salinity. The rising trends down the river system, as illustrated in the Figure shows the impacts of Lake Beseka and other saline waters entering the Awash.



The AWASH Catchment in Ethiopia



Rising Trends in Salinity Along the AWASH

UK WORK

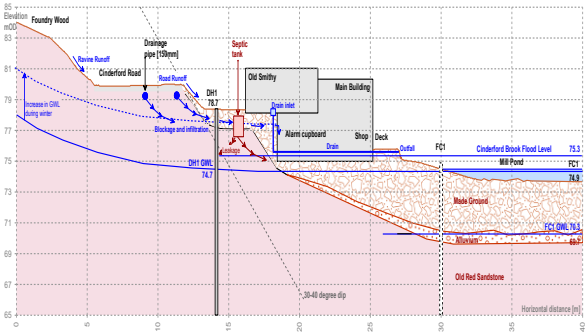
Dean Heritage Centre Hydrogeological Survey

During 2025, WRA carried out a detailed groundwater, surface hydrology and geotechnical investigation, to understand water ingress affecting the Dean Heritage Centre and building subsidence at the Foresters Cottage, applying groundwater, geotechnical and hydrodynamic modelling to produce design of mitigation measures.



Water wheel at site used to produce electricity

It was found that water ingress is primarily caused by stormwater infiltration along the road corridor into rubble back-fill under the first-floor space, aggravated by high groundwater levels in winter. Runoff from three ravines on the steep Foundry Wood hillside cascades on to Cinderford Road, and merges with road ponding and infiltration into obsolete road drainage. Existing pipes need to be removed, injecting cavities with resin or bentonite-concrete mix to seal sub-surface voids, and rebuild with larger pipes, capture basins, headwalls, debris grills, culvert, access wells, and outfall.



Geological Cross-Section through Dean Heritage Centre

A horizontal aquifer drain would resolve high ground water levels, consisting of well screen installed in a borehole drilled sub-horizontally in Old Red Sandstone to the rear of the ground floor walls. This requires a caisson well for drilling and capture, before conveyance to a discharge well joining the water wheel culvert.

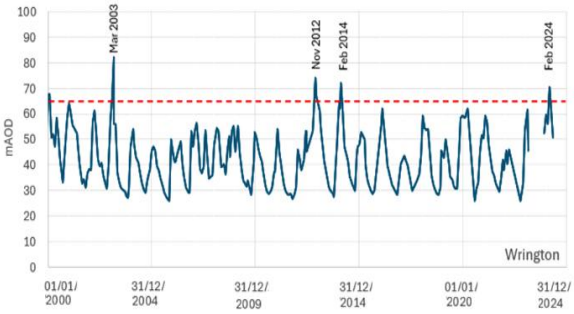
Cinderford Brook spills annually across the mill dam and floods low-lying areas, flooding the old mill building to a depth of 0.7 m. Passage of floodwater over the mill-dam causes erosion, which requires an increase in weir capacity and construction of a new spillway and channel to the top of the first waterfall.



Flood extent mapping using HEC-RAS 2D Hydrodynamic model

Groundwater Resurgence at Claverham, Yatton

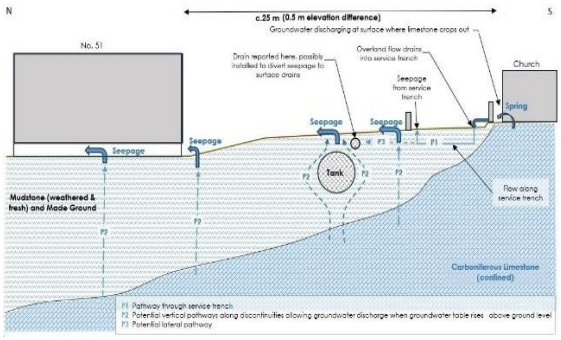
In association with Hafren Water, WRA investigated the origin of groundwater emerging around private properties and a Catholic Church in 2012, 2023 and 2024, documented by North Somerset District Council.



Groundwater hydrograph for Carboniferous Limestone

The source of flooding on all occasions is groundwater resurgence from Carboniferous Limestone under the Catholic Church, as a consequence of high groundwater levels generated by exceptionally high rainfall. Ingress around the private properties is more complex due to overlying mudstone, made-ground, man-made pathways introduced by site re-development and potentially by below-ground structures associated with the former use as a petrol station.

Mitigation measures would be based on a groundwater drainage scheme.



Hydrogeological conceptual model

Next WRA Board Meeting

January 2027

The WRA Bulletin is a quarterly publication, and relies on contributions submitted by Partners, Associates and Consultants. The document is circulated by email, and published on the WRA web-site, aiming to keep the WRA network up-to-date with respect to current activities. Please email contributions for future issues to Paul Whitehead: paul.whitehead@watres.com

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