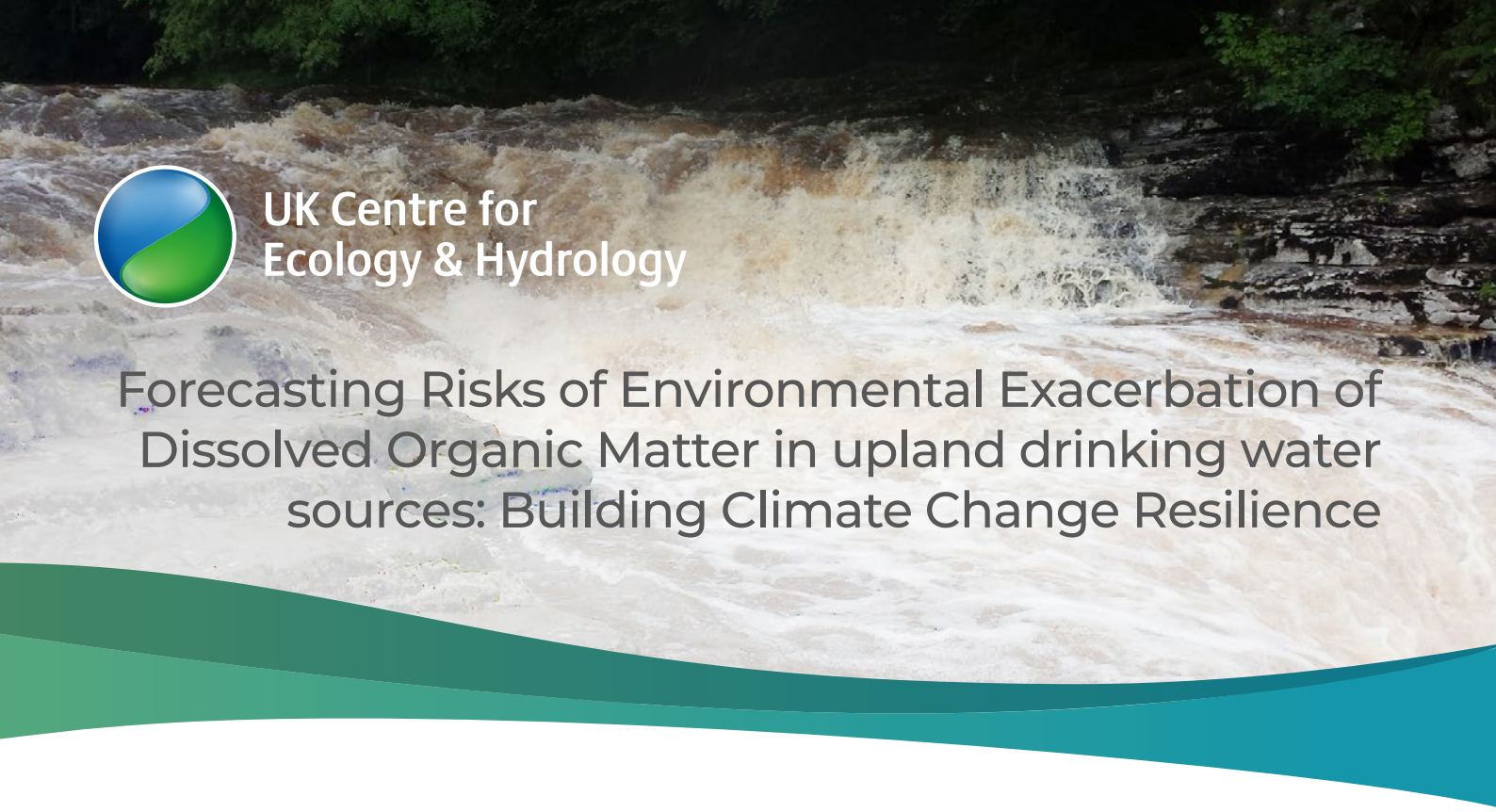

UK Centre for Ecology & Hydrology

Forecasting Risks of Environmental Exacerbation of Dissolved Organic Matter in upland drinking water sources: Building Climate Change Resilience

An introduction to the FREEDOM-BCCR project

The FREEDOM-BCCR project has been developing a clearer understanding of how climate change will influence future concentrations and treatability of dissolved organic matter (DOM) in upland drinking water source waters, and exploring options available to the water industry to mitigate potentially deleterious changes. It developed through iterative exchanges between catchment managers and engineers representing several UK water companies dependent on upland water sources, and environmental scientists. This briefing note introduces the main areas of investigation. One of the key aims of FREEDOM-BCCR was to conduct a series of evidence reviews focussed on options for increasing the resilience of the upland drinking water supply to anticipated climate induced changes in DOM. The outcomes of these reviews, and a summary of the underpinning modelling work, are summarised in an additional set of four accompanying notes.

DOM in upland drinking water supplies: provenance and issues for the water industry

The soils of the upland catchments that provide the UK with the majority of its drinking water typically contain high amounts of organic matter. Some of this is released into streams and reservoirs in the form of DOM, resulting in a brownish staining of the water. Other less-coloured forms of DOM can also be present in upland water supplies, particularly as a result of algal growth and decay. Water companies treat the “raw water” with coagulants, filters and absorbents to prevent DOM concentrations exceeding operational thresholds. This is vital to avoid the production of potentially toxic disinfection by-products (DBPs) during chemical treatment, algal fouling of water treatment works (WTWs), and problems with taste and odour that can be of concern for the consumer.

Long-term increases in DOM

Concentrations of DOM in upland waters have been rising over recent decades. Consequently, the cost of water treatment has been escalating due to the increased use of coagulants and, in some cases, the need for investment in new treatment facilities. The primary driver of the long-term increase is thought to be a rise in the solubility of soil organic matter as soils recover from the effects of acid rain. However, DOM concentrations in upland waters have also been shown to be sensitive to fluctuations in soil temperature and rainfall. While acid rain has now fallen to very low levels, modelling work under the FREEDOM-BBCR project indicates that future climate change could result in even higher DOM concentrations in some catchments than are currently being experienced.

Increasing the resilience of the water supply to future climate change

Future warming of soils, driven by global climate change, is likely to result in significantly higher DOM concentrations in water draining peat-dominated catchments particularly, and levels could be further exacerbated if rainfall events become more frequent and intense. Modelling of these effects during the FREEDOM-BBCR project has shown that the sensitivity of the DOM response to climate change varies between catchments, and indicates that the current treatment capacity of some WTWs, where concentrations are approaching the upper end of the treatable range, may be at risk. There is therefore a pressing need for the water industry to consider which of their upland drinking water assets are most vulnerable to the effects of climate change on DOM, and the options available to them to improve the resilience of the upland drinking water supply through adaptation or mitigation. These options were considered during a series of evidence review seminars held with industry partners during the summer of 2020, and are summarised in the following accompanying briefing notes:

2 Rising concentrations of dissolved organic matter in drinking water supplies: can peatland restoration help?

3 Is there potential to manage dissolved organic matter concentrations within upland reservoirs?

4 How can advances in dissolved organic matter characterisation lead to more effective water treatment?

A fifth accompanying note summarises the modelling work under the FREEDOM-BCCR project that is helping to improve understanding of the effects of climate change on DOM production in the upland drinking water supply:

5 How will climate change influence levels of dissolved organic matter in upland drinking water sources?

Take-home message: Concentrations of dissolved organic matter (DOM) in upland drinking water supplies have been rising over recent decades and are likely to rise further in response to anticipated changes in climate. This phenomenon is of concern to the water industry as it is increasing the cost of treatment, and in some cases threatens to overcome the current treatment capacity of some water treatment works (WTWs). The FREEDOM-BCCR project has been helping the water industry to understand how vulnerability to climate change effects on DOM varies across its upland drinking water assets, and the options open to it to adapt to, or mitigate, the threat across the catchment to WTW continuum.

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About the FREEDOM-BCCR project

FREEDOM-BBCR (Forecasting Risks of Environmental Exacerbation of Dissolved Organic Matter in the upland drinking water supply – Building Climate Change Resilience) is led by the UK Centre for Ecology & Hydrology and funded by the Climate Resilience Programme (www.ukclimateresilience.org) - jointly led by UK Research & Innovation (UKRI) and the Met Office under the Strategic Priorities Fund (SPF).

Through the development of a community of scientists and water industry representatives, FREEDOM-BCCR aims to improve understanding of the risks posed by climate change to the quality of water in upland drinking water sources and develop a conceptual framework of mitigation and adaptation options to maximise the future resilience of the supply. The vision of the Climate Resilience Programme is "To enhance the UK's resilience to climate variability and change through frontier interdisciplinary research and innovation on climate risk, adaptation and services, working with stakeholders and end-users to ensure the research is useful and usable."

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