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# Flow source drives extreme variation in dissolved organic carbon in an important North American Great Plains reservoir

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Elevated dissolved organic carbon (DOC) concentrations are a major concern for drinking water treatment plants that draw from surface waters, owing to effects on disinfection byproduct formation, risks of bacterial regrowth in water distribution systems, and treatment costs. Yet within the vast Great Plains of North America water supplies are limited. As a result, water utilities often rely on water bodies with naturally elevated DOC. Using a 30-year data set encompassing both extreme wet and dry conditions we investigate the drivers of high variation in DOC, exploring effects of changing flow management and in-lake water chemistry. Using wavelet coherence analyses and generalized additive models of DOC, we find DOC concentration was significantly coherent with flow from a large upstream mesotrophic reservoir. DOC was also coherent with sulfate, total phosphorus, ammonium, and chlorophyll *a* concentrations across the 30-year record. These variables accounted for 56% of the deviance in DOC from 1990 to 2019, suggesting that water source and in-lake nutrient and solute chemistry are effective predictors of DOC concentration. Clearly, climate and changes in water and catchment management will influence source water quality in this already water-scarce region. Our results highlight the importance of flow management to shallow eutrophic reservoirs and demonstrate impacts on source water quality. Results also highlight a key management challenge where wet periods can exacerbate water quality issues and these effects can be compounded by flow rules that dictate reducing inflows from systems with lower DOC. Our work shows that current flow management decisions to address water level and flood risk concerns also have important impacts on drinking water treatability, creating important tradeoffs and highlighting complex challenges for regional water security.