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Net Nutrient Uptake in the White River, Northwest Arkansas, Downstream of a Municipal Wastewater Treatment Plant

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ABSTRACT

Wastewater treatment plays a crucial role in preserving water quality in receiving streams; however, continuous nutrient enrichment can diminish the retention capacity of rivers. The objectives of this study were to evaluate the effects of wastewater treatment plant effluent and river discharge on water chemistry and determine the retention efficiency of nutrients added in the effluent along a 6.1-km reach of a 5th-order stream in the Ozark Highlands of northwest Arkansas. From 2006 through 2007, effluent discharge increased river nitrite, soluble reactive P (SRP), and total organic C (TOC) and conductivity. As river discharge increased, DO and turbidity increased, but water temperature, conductivity, and TOC decreased. Net nutrient uptake lengths were inconsistent for NO3-N, NH4-N, and SRP. Results indicated that the fluvial channel acted as both a sink and a source of NO3-N and SRP, but the channel always acted as a sink for NH4-N with a significantly positive retention coefficient that indicated only 12% of added NH4-N was retained in the study reach. The effluent discharge increased the concentrations of seven water quality parameters, and it appears the long-term enrichment has rendered the immediate-downstream reach ineffective as a nutrient sink. Nutrients added in the effluent were generally transported with little to no uptake or transformation, thus river chemical concentrations beyond the study reach have likely been influenced by this effluent discharge.

KEYWORDS

Streamflow, Point-Source Pollution, Nutrient Spiraling, Source-Water Protection

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