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Transport and metabolic fate of sewage particles in a recipient stream

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Although the implementation of wastewater treatment plants (WWTP) has dramatically increased the quality of surface waters in urbanized areas, WWTPs can still discharge noticeable amounts of solutes and particles to recipient streams. While the fate of WWTP nutrients has received considerable attention, transport and in-stream transformation of sewage-derived particulate organic matter (SDPOM) have not. To investigate the transport and transformation of SDPOM in recipient streams, we experimentally injected fluorescently labeled SDPOM into a headwater stream and tracked its downstream fate at baseflow. Most SDPOM disappeared from the streamwater within a 160-m long reach with an average deposition velocity of 0.14 mm s^{-1}. We further coupled hydrometric measurements of specific water fluxes through the streambed interface with a mixing model to estimate streambed oxygen removal, and found significantly higher oxygen removal in the deposition (0.75 g O_2 m^{-2} d^{-1}) than in the downstream post-deposition (0.36 g O_2 m^{-2} d^{-1}) sub-reach. Contrary to our expectations, we did not detect any apparent effect of SDPOM deposition on streambed clogging. Our results show the capacity of a recipient stream to retain SDPOM and to reduce its downstream export, and thus contribute to a better understanding of ecosystem services of human-altered streams.