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NUTRIENT AND FECAL MICROBE SOURCES FOR A EUTROPHIC LAKE AND
RECOMMENDED REMEDIATION STEPS,
WILGREEN LAKE, MADISON COUNTY, KENTUCKY

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Wilgreen Lake is a man-made lake, classified as nutrient-impaired (303d list) by the EPA and State of Kentucky. The lake drains a watershed with residential developments, cattle pasture, modified woodlands, and some industrial/urban usage in the city of Richmond. The principal tributaries are Taylor Fork and Old Town Branch that meet to form the trunk of the lake approximately one mile in length. The upper reaches of Taylor Fork are adjacent to a densely-packed (quarter-acre lots) housing development with septic systems, and its watershed drains some portions of southern Richmond. Old Town Branch drains cattle pasture and residential areas of moderate to large lot size. An intermittent tributary flowing into Pond Cove drains cattle pasture and one small housing development.

Fecal material contributes both nutrients and microbes to Wilgreen Lake. Both cattle and human fecal material enter the lake as documented by high fecal microbes counts and DNA tracing techniques. DNA tracing methods are limited by our sampling frequency but show that bovine *Bacteroides* microbes dominate water samples even at loci where suspected septic effluent enters the lake. The nitrogen isotopic composition ($\delta^{15}\text{N}$) of lake plankton and algae are broadly consistent with nitrogen input from human fecal material, but results are equivocal. We suspect that large amounts of nutrients do enter the lake through septic groundwater input, however, the strong bovine signal clearly suggests deployment of remediation methods that would limit runoff from pastures adjacent to Wilgreen Lake and within its watershed. Such methods include fencing cattle off from drainages and the lake, and planting vegetative buffers around stream and lake margins. Our data alone cannot justify elimination of septic systems by costly implementation of a sewage treatment system.

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