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Fate of Wastewater Discharged by Onsite Systems

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There seems to be misunderstandings of the fate of wastewater that enters and is treated by onsite wastewater management systems (septic systems). For example, a series that recently aired on WSB-TV entitled "Water Solutions for Atlanta's Future", made the claim that water used in septic systems did not return to rivers locally (unlike sewer systems) and therefore, represented "consumptive use". Quoting from the series:

> The real problem for the man down stream is the man-made enemy, a million septic tanks under Atlanta's recent growth which do not put water right back into the river. You take it and put it into the aquifer and it goes into the ground water system and into south Georgia.

All of the water that enters a properly functioning onsite system enters the soil which provides treatment so that the wastewater becomes “water” before it returns to ground and surface water. A portion of the wastewater discharged into the soil returns to the atmosphere as evaporation and transpiration by plants, but the major part of the wastewater moves below the root zone of plants and on to the shallow ground water. Water entering this aquifer in the metro Atlanta region does not go to south Georgia. The deep aquifers in south Georgia that are mainly used as sources of water for municipal, industrial, and agricultural needs are recharged by water from precipitation that infiltrates in the area just south of the fall line that extends from Columbus to Macon to Augusta, not in the Atlanta region. The only water that moves from the Atlanta region and the rest of the Piedmont and Blue Ridge Mountains to south Georgia is that that flows in the rivers.

The common perception that onsite systems are 100% consumptive users of water, i.e. all of the water goes to ground water or is evaporated or transpired to the atmosphere, and none is returned to local streams, is also a misperception. The first part of this statement is true. In a properly functioning onsite system, all of the water returns to the atmosphere or moves to ground water. Streams in Georgia, however, are fed by ground water. The water from onsite systems that moves to ground water raises the local water level which pushes water into the nearest stream, just as adding a marble to one end of a tube filled with marbles causes a marble to pop out of the opposite end. It may take months to years for the "new water" that is discharged from the onsite system to reach the stream, but it pushes out "old water" next to the stream within hours to days.

A valid question is the relative amount of water entering the soil from an onsite system goes to groundwater as opposed to being taken up by lawn grass roots and transpired or moves up to the soil surface and evaporates. Evaporation and plant transpiration represent true losses of water (consumptive use) that will not return to streams (except as rainfall). We used a computer model of an onsite system to answer this question. The simulated septic system was a typical design used in the Atlanta area with a trench installed at a depth of four feet below the soil surface. The

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simulation assumed that lawn grass roots penetrated to a depth of three feet, and the weather data used was from Athens, Georgia for 1995 which was a nearly "normal" year with 55 inches of rainfall. We assumed a typical three-bedroom home with a daily onsite system discharge of 450 gallons per day and 300 feet of septic trench line. We found that 91% of the water discharged into the soil by the onsite system went to groundwater. These results clearly indicate that the majority of water discharged into onsite systems is not consumptively used and instead returns to local streams through the ground water system.

In fact, if the hydrologic balance for the Georgia is considered, water discharged into the soil by onsite systems more closely mimics natural conditions than water discharged directly into streams by centralized wastewater treatment facilities. Most of Georgia receives an average of about 50 inches of annual precipitation. Under natural conditions, about 30 inches of this precipitation returns to the atmosphere by evaporation and plant transpiration, and about 20 inches moves to the shallow ground water. When the region around Atlanta was forested prior to settlement, almost all of the rainfall infiltrated into the soil and little entered streams by overland flow. Thus, about 20 inches of the annual precipitation moved through the soil to ground water and on into streams. Ground water was the only source of water in streams between rainfall events, especially if the time between rainfall events was relatively long.

With settlement and development, the soil surface becomes covered by roofs, streets, parking lots, and other impervious surfaces. Thus, less of the rainfall infiltrates into the soil and more goes to streams by overland flow. The increased runoff from impervious surfaces causes stream levels to rise rapidly during rainfall events, and the subsequent decline in stream flow is also relatively rapid. Increased runoff decreases the proportion of the rainfall that goes to ground water which also feeds the streams. Thus, less of the stream flow is from ground water discharge and theoretically, stream levels are lower and stream flow is less after development in the watershed than would be the case the watershed is undeveloped and forested. This effect may be most important during periods of drought. Because surface cover has reduced ground water sources for stream flow, streams will tend to dry up more quickly during drought than would have been the case under natural conditions.

The path of water movement associated with onsite systems; from the home, to the soil, to ground water, and on to the stream; helps maintain stream flow levels during periods of drought. It is during these drought periods that stream flow levels are most critical to provide for water needs downstream including maintenance of ecosystem health and function. Thus, rather than being consumptive users of water and reducing stream flow, onsite systems help maintain the natural path of water movement to streams under which the stream network developed.

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