

The Hidden Reservoir: Groundwater

by Parker Pringle

2009

Groundwater is the lifeblood of the watershed: without groundwater, no running water in the creeks; no otters, no turtles, no ducks. Groundwater makes possible the entire creek ecosystem. But urbanization has had major negative effects on groundwater that need to be addressed in order to restore the vitality—and guarantee the existence— of creeks in the Ross Valley.

Groundwater refers to subterranean water that fills all the spaces in and between the ground's particles, just like milk surrounds and saturates your Cheerios. In the valleys, groundwater is stored in clay, silt, sand and gravel deposited during millennia by the creeks on top of the impervious bedrock. In the hills, groundwater is in the thin layer of soil and broken rock over the bedrock. A small amount of groundwater fills cracks in the bedrock.

This underground reservoir is fed by rain, which penetrates the soil and seeps down to the water table to become groundwater. In the Ross Valley, groundwater is not under the high pressure that pushes water uphill like the water that flows from a faucet or an artesian well.

Instead it is forced by gravity and atmospheric pressure to flow, quite slowly, downhill toward low points in the water table. Many low points are creeks, which constantly drain groundwater from the watershed.

Due to this draining, during the dry season the water table drops in elevation and lessens in slope. The flow of groundwater to the creeks slows and they carry less water. In certain places creeks stop flowing until fall and winter rains recharge the groundwater reservoir and raise the water table above the creek. So creek flow and life are directly related to the amount of groundwater that the valley can store above the elevation of the creeks. Unfortunately, urbanization of the watershed has had negative effects on the groundwater reservoir.

One major effect is caused by impermeable surfaces such as roads, roofs, patios, and sidewalks. These prevent rain from infiltrating the soil and becoming groundwater. Consequently, the watershed enters the dry season with less groundwater. This leads to lower stream flows and impairs the creek ecosystem every year. To increase groundwater recharge, people can use permeable surfaces around their homes like gravel rather than concrete. Also, gutters can be routed to drainage swales rather than to storm drains.

Phoenix Dam on Ross Creek also has an effect on the amount of groundwater available to the creek. Built of clay on impermeable bedrock, the dam blocks not only the surface flow of the creek, but also the flow of groundwater. This contributes to the annual drying-up of Ross Creek in early summer. However, because long-time residents say there was year-round flow in the creek for decades after the dam was built, it's likely that wells are also a significant factor.



San Anselmo Creek's summer flow is dependent on a well-charged aquifer in the Ross Valley. Photo by Charles Kennard

Wells are a problem in two ways. First they remove groundwater that would otherwise make its way into our creeks. Second, they create new low points in the water table, which changes the direction of groundwater flow. Instead of flowing toward the creek, groundwater flows toward the well.

In these two ways, wells lead to higher water temperatures and lower flows in the creek, ultimately creating a stressful situation for fish. Wells may even de-water creeks. Fairfax and Ross creeks historically flowed year-round but now long stretches go dry in the summer. Wells may be the main culprit.

Wells lowering the water table may also contribute to the uncharacteristically short lifespan of valley oaks in the Ross Valley. Citizens, cities, and schools can directly contribute to creek vitality by not using wells. The water seems free, but in truth it comes at a steep price, paid by the creek ecosystem.

Old, cracked, and leaky sewer mains and laterals also affect groundwater. In a big storm, when the water table is above a cracked pipe, groundwater pours into the sewer system like bath water down a drain. This reduces groundwater recharge (and can overwhelm the sewer collection system and treatment plant, leading to spills).

Ongoing maintenance and replacement of old sewer pipes by the Ross Valley Sanitary District is improving this situation. Maintenance of sewer laterals, however, is the responsibility of homeowners.

Groundwater is also affected by pollutants from the surface. Fertilizers, pesticides, soap, and oil, for example, are carried by rain to the water table and by groundwater into creeks. These pollutants impair water quality and harm the creek ecosystem. To prevent pollution, people can use fertilizer sparingly, clean up after their dogs, use biodegradable soap, and properly dispose of hazardous wastes like oil and paint.

Groundwater is life for the creek and its inhabitants. More groundwater means more life in the creek. The communities of the Ross Valley have a tremendous influence over the quantity and quality of our groundwater and thus on the life of the creeks. Understanding and exercising this influence beneficially is a major part of being a steward of the watershed.

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