Practical Limnology – What Are We Drinking?

By Dr. John Hains, Clemson University, Clemson Public Service and Agriculture (PSA)

In this series I will attempt to answer some questions folks (and FOLKS) have about what is in our drinking water, with emphasis on water from Lake Keowee. This first installment addresses where it comes from and what happens to it on the way to the lake.

Normally, this time of year I am trying to remind folks that the seasons have nothing to do with how close the earth is to the sun, but rather are a result of the tilt of the earth on its axis. (We're closest on 3 January and hope I don't have to explain further.) However, there seems to be greater interest (understandably) in the sources and processes that are related to the water we drink. In that spirit I will attempt to satisfy curiosity.

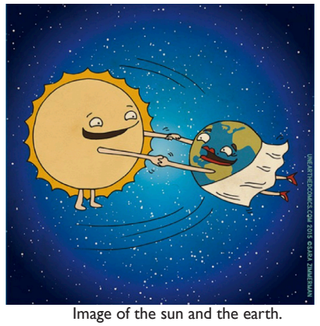
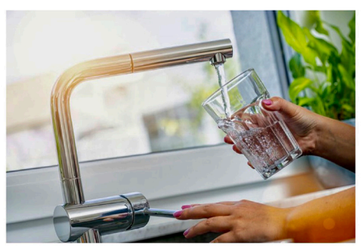


Image of the sun and the earth.

First, is it worth noting that in our lifetimes it is probable that we drank and had within our bodies at least a few water molecules that were previously shared by Julius Caesar or any number other ancient animals, perhaps even the dinosaurs. In this sense we are just part of the "water cycle," temporary custodians as we drink it, sweat it, exhale it, or eliminate it in other ways—especially after we drink coffee. Water is essential for life, but we continually lose it from our bodies. And second only to lack of oxygen, absence of drinking water will cause our quickest mortality. Thirst is a powerful urge that, under the worst circumstances, may motivate us to drink unbelievably dirty water. But we can put those morbid thoughts aside in our region because we have access to some of the cleanest, most abundant water in the world.

Lake Keowee (and other reservoirs in the area for that matter) supply drinking water to many of us. It arrives as precipitation on the watershed and accumulates in the impoundments. Then it is pumped out, processed, and delivered to our homes and businesses in a vast distribution system. I will note the list of permitted water withdrawals in the next article, but regardless of where on the lake or what tributary it comes from, water that comes out of the tap is different from what we accidentally swallow when we go for a swim. So, what's "in" the tap water and how does "it" get there? Please bear with me, there are going to be some technical terms.



rclassenlayouts / Getty Images

First remember, although rainwater is "distilled" in the atmosphere, it isn't pure. It absorbs gases from the atmosphere and almost always acquires a mildly "acid" pH as a result. Atmospheric pollutants such as oxides of sulfur and nitrogen can "acidify" it further, actually causing impairment in some places. (The clean air act has greatly improved water quality through regulation of what can be emitted to the atmosphere.)

Aerial view of Lake Jocassee

If the watershed is forested, precipitation may absorb more chemicals from vegetation and soil. Moreover, even in our region, dominated by granitic rock with minimal amounts of calcium and magnesium, the water nevertheless dissolves very small amounts of silicates and metals like iron or manganese. Our beautiful Blue Ridge Mountains and surrounding hills are very, very, slowly dissolving (melting much more slowly than the proverbial wicked witch). The water that accumulates in area reservoirs contains minute amounts of dissolved solids, often lumped together as total dissolved solids (TDS), derived from natural sources. Indeed, one of the reasons that we are unlikely to have a problem with invasive zebra mussels is our low concentrations of calcium.

Many of the inorganic chemicals in water can form ions that impart, more or less, the ability of water to conduct electricity. This property is called "specific conductance" (SpCond) and it is measured with a fancy volt/ohm meter. Our water in this region has exceedingly low SpCond. Water in streams entering Lake Jocassee, for example, often has values in the range of 20 µS (microSiemens, a measure of conductance) or less. This is also true for the reservoirs supplying water for the Greenville water system. In comparison, the Great Lakes have SpCond values that are typically 10 times greater, or more. If SpCond is very low, then there the water is unlikely to have much of anything (contaminants) dissolved in it, with some exceptions.

Contaminants are the most drastic damaging variable to any water system. While some pollution can be obvious with the naked eye, some are more discreet. You may also not be able to get a physical look at the water while the system is on.

For that, tracking the conductance and salinity of the water is the best way to note pollution. Monitoring that will keep your waters clean and you alerted when a damaging change happens.

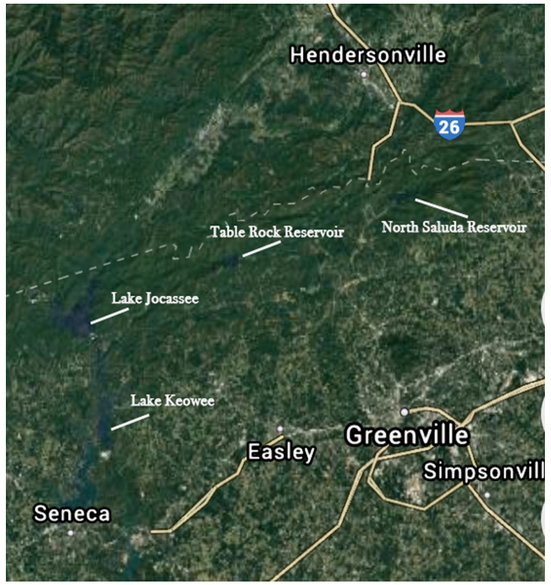
	uS/cm
DISTILLED WATER	0.5 - 3
MELTED SNOW	2 - 42
TAP WATER	50 - 800
POTABLE WATER IN THE US	30 - 1500
FRESHWATER STREAMS	100 - 2000
INDUSTRIAL WASTEWATER	10000
SEAWATER	55000

Freshwater has a wide conductivity range due to geology effects. Freshwater that runs through granite bedrock will have a very low conductivity value.

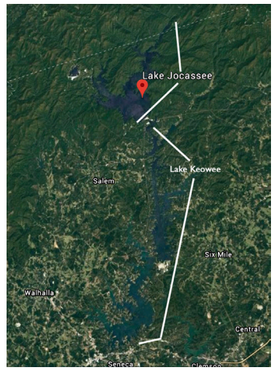
Our upstate watersheds have few sources of pollutants and our soils usually require added fertilizer to grow abundant crops. Thus, lakes near the top of the watershed like Lake Keowee typically have good optical clarity (not much algal biomass suspended in the water). This clarity often changes with age, and reservoirs tend to "age" more quickly due to their relatively larger watersheds and the inflows of all sorts of materials, some of which also affect what we drink. As demonstrated by Table Rock and North Saluda Reservoirs in the Greenville water system, careful and diligent protection of the surrounding lands can ensure that the reservoirs remain pristine for a very long time. In contrast, soil disturbance and development of housing, roads, etc., can bring about changes that are more rapid.

Lake Keowee has the added advantage of sharing and exchanging its water mass with Lake Jocassee through the action of pumped storage. This ensures that at least part of Lake Keowee will have qualities very similar to Lake Jocassee. For the purpose of human consumption this is a good thing.

Of course, as we humans continue to develop and modify the landscape in the watershed, as well as add pollutants (fertilizers, pesticides, organic chemicals from pavement, paints, lubricants, etc.), Lake Keowee may experience changes. If that occurs, and if the tendency of Lake Jocassee to "trap" materials is overcome, then what we swallow when we fall out of the boat on Lake Keowee may change as well. But this article is all about where the water comes from and the kinds of things that are dissolved or suspended in the water from normal processes. The next articles will address the things we do that are intentional—in order to provide safe drinking water. That is where most of your questions will be answered. ❖



Above: Overall Google map of the four reservoirs.
Below: Google maps of individual reservoirs



Google map of Lakes Jocassee and Keowee

Map of Table Rock Reservoir

Map of North Saluda Reservoir