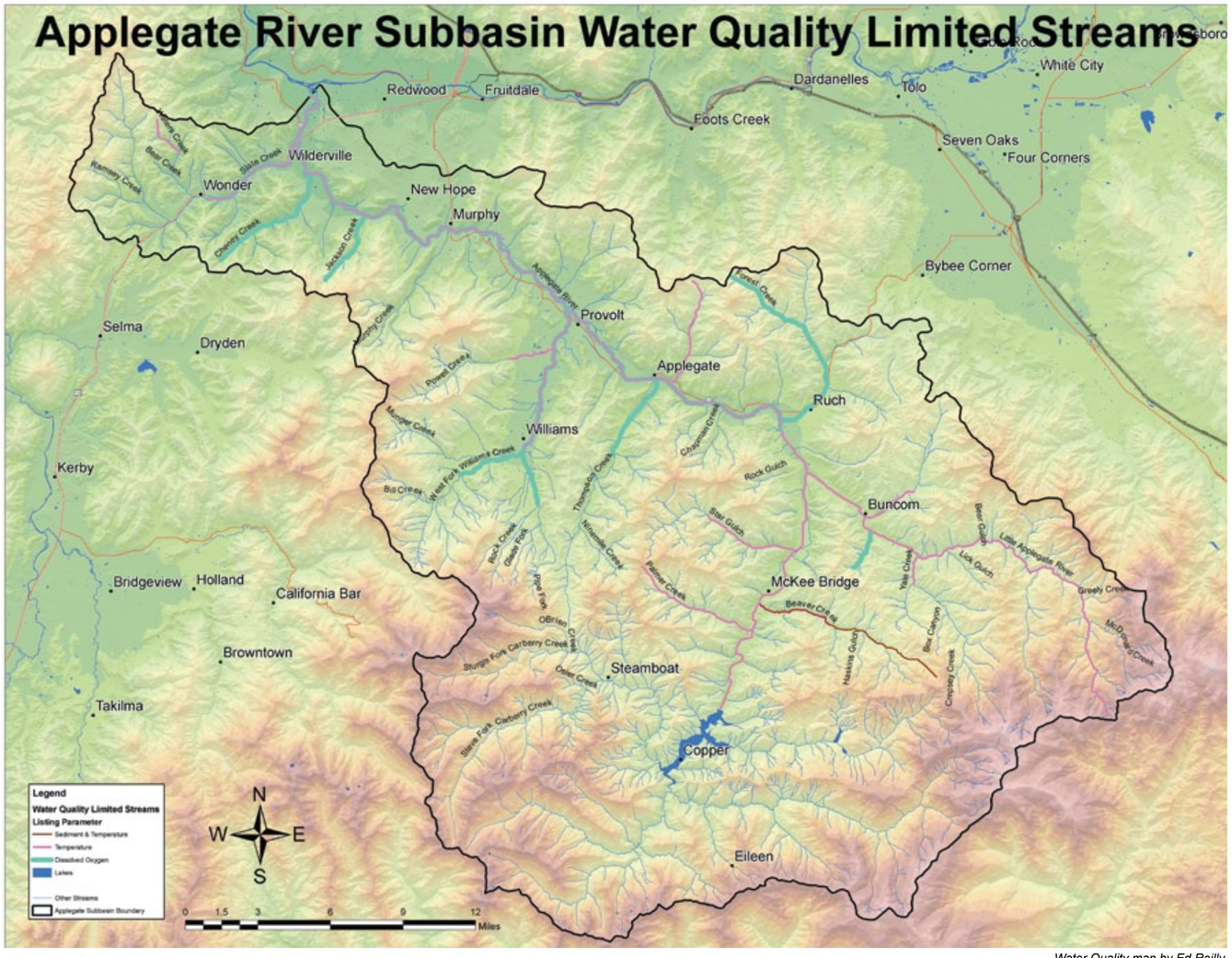

Water Quality map by Ed Reilly.

Applegate River Water Quality

BY CHRIS VOLPE

Water quality has been a concern in the United States for many years, and has prompted several acts of congress, which have resulted in legislation intent on maintaining and improving the overall quality of our nation's bodies of water. The multitude of laws and regulations are complex, involve many different agencies, and could fill several large volumes. Presented in this article is a very condensed description of how water quality standards came to be, and what it means for aquatic environments in the Applegate Subbasin.

In 1977, Congress passed The Clean Water Act (CWA), which today is the primary law governing water quality. The act authorized states to develop water quality standards. In Oregon, the Oregon Dept. of Environmental Quality (ODEQ) is the principle regulatory agency in charge of setting and enforcing these standards. To accomplish this, the ODEQ has established criteria for a suite of different water quality parameters. These include temperature, fine sediment, turbidity, dissolved oxygen, bacteria, pH, and many other chemical and nutrient categories. Streams failing to meet water quality criteria for one or more parameters are placed on the 303(d) list (a reference to a section of the CWA). Water Quality Management Plans (WQMP) are then developed for these impaired streams, and a Total Maximum Daily Load (TMDL) is established by the ODEQ. A TMDL represents the maximum amount of a particular pollutant that a given water body or stream reach can receive and still meet water quality standards. Once a TMDL has been established for a listed stream reach, it is removed from the 303(d) list, though it is still considered water quality limited. Pollutants are classified as "Point" and "Non-point" sources. A point source of pollution generally has a well defined point of entry into water bodies. For example, a large mining operation which discharges polluted water into a stream. Point sources of pollution are required by law to be permitted by the National Pollutant Discharge Elimination System. Nonpoint sources of pollution generally have less defined points of entry, and do not require a permit. A good example of nonpoint source pollution would be water temperature increases resulting from reduced riparian vegetative cover. A WQMP has been developed for the Applegate River subbasin, and is available on line at: http://www.deq.state.or.us/WQ/TMDLs/docs/roguebasin/applegate/wqmp.pdf

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Generally speaking, water quality throughout the Applegate subbasin is relatively good, but there are impacted stream reaches which could use some improvement. These areas are highlighted on this map (data and GIS layers from ODEQ). Three water quality parameters have been identified as failing to meet water quality standards in the Applegate: Temperature (the pink streams reaches), Dissolved Oxygen (green), and Sedimentation (brown). No standing water bodies (lakes, reservoirs, etc.) have been identified as being water quality limited in the Applegate. Listing criteria are set to the most sensitive beneficial uses of that water. In the Applegate, the most sensitive beneficial uses are cold water aquatic life, such as salmon and trout.

Temperature

In the Applegate Subbasin, streams are listed as water quality limited for temperature if their average maximum high temperature for 7 consecutive days or more exceeds 18.0o C (64.4o F), the criterion set for salmonid rearing and migration use. Temperature is very important to our native salmonids. As exothermic organisms, their metabolism is directly related to the temperature of their environment. Water that is too warm or too cold can have detrimental effects on migration, spawning, egg incubation, and rearing. As such, salmon, trout and steelhead have relatively narrow temperature tolerances, generally from about 39o F to roughly 64o F. Temperatures outside of this range limit metabolic efficiency, and can lead to reduced mobility and growth, increased stress, and death if excessively warm water temperatures persist for too long. Temperature is also important to other aquatic organisms, such as aquatic insects, the primary food source for juvenile trout and salmon. Generally speaking, streams which suffer from higher water temperatures have less diversity of insects. The single largest factor influencing water temperature is, intuitively enough, how much sunlight a stream or reach is exposed to. The more shade afforded to a stream, the cooler the water temperatures will be. Water quantity also plays an important role, as it takes more energy to heat larger amounts of water. Streams impacted by drought and water withdrawals will warm faster than streams with higher volumes of flow.

Dissolved Oxygen

The mainstem of the Applegate is listed for failing to meet Dissolved Oxygen (D.O.) criteria, set for spawning by cold water fish at 11 mg/l. All other reaches identified on this map are listed for failing to meet cold water criteria established for D.O., at 8 mg/l. The D.O. content of water is a measure of oxygen saturation in the water; in other words, how much oxygen is available for aquatic organisms. If D.O. is too low, organisms metabolic efficiency becomes impaired, affecting swimming performance, feeding, and growth. If levels fall too low, aquatic life will suffocate. Note on the map the many reaches listed for D.O. are also listed for temperature. This highlights an important relationship between the two parameters; the amount of oxygen that can be saturated in water decreases as water temperature rises. Warm water can hold less oxygen than cold water. Another factor that influences D.O. in water is respiration by plants, which while they do produce oxygen, also produce carbon dioxide as a normal process of photosynthesis. Algae blooms in water bodies have been known to rapidly deplete D.O. Decomposition of organic material can also deplete D.O. When large algae blooms die off, it is often accompanied by a decrease in oxygen content. Low D.O. levels correspond to reduced bio diversity of aquatic insects, much the same as high temperature levels do.

Sediment

"The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed." defines the sediment criteria. In the Applegate Subbasin, only Beaver Creek has been listed as water quality impaired for sediment. Sediment is manifested in two forms: as a layer of fine (< 2 mm in size) particulates that coat the stream bottom, and turbidity. Turbidity is fine sediment that has become entrained in the water column and carried downstream by currents, and is a separate parameter from sediment, complete with its own listing criteria. No streams in the Applegate are currently listed for turbidity. In excessive amounts, both sediment and turbidity are detrimental to aquatic life. Fine sediment can fill in pools, cover spawning substrates (gravels and cobbles), smother incubating eggs, and reduce the amount of accessible suitable substrate for aquatic insects. Turbidity can reduce feeding opportunities, and may cause avoidance of reaches by salmonids. There are many sources of fine sediment. Some comes from natural erosive processes, and in the correct quantities, some fine sediment is beneficial to the stream environment. Non natural sources include roads, streamside disturbances such as mining or agricultural practices, and failures of structures such as culverts and ditches.

In the Applegate, roads are probably the single greatest source of chronic annual sediment input into the aquatic environment. Roads constructed on steep hill slopes which have a high degree of hydrologic connectivity (stream crossings) are generally the worst culprits, especially those constructed in areas of highly erodible soils, such as decomposed granite. Large episodic inputs typically occur only occasionally, usually following a significant precipitation event, but when they do the effects can be high in magnitude.

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The recent McDonald Ditch failure is an example of just such an event, which resulted in many cubic yards of sand deposition into the Little Applegate River.

Common indicators of these three water quality indicators are aquatic insects, which are sensitive to temperature, D.O., and sediment. For this reason, they are often utilized as a way to assess the health of the aquatic environment. When insect communities contain abundant members of the Trichoptera (caddisflies), Plecoptera (stoneflies), and Ephemeroptera (mayflies) families, it is an indicator of high water quality, while an overabundance of insects from the chironomidae family (midges) often indicates poor water quality.

For those of you interested in more detail regarding water quality in particular streams in the Applegate or elsewhere in the Rogue basin, the ODEQ maintains an excellent web site useful for querying particular streams, by subbasin and/or listing parameter, for water quality. This web address will get you to the query: http://www.deq.state.or.us/wq/assessment/rpt0406/search.asp#db.

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