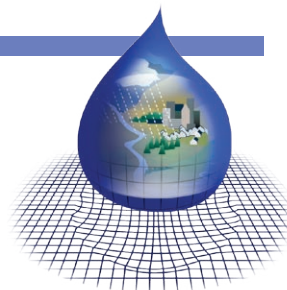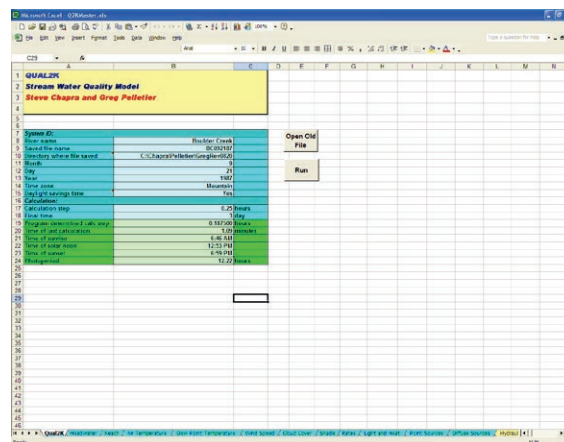# Stream Water Quality Model (QUAL2K)

QUAL2K (or Q2K) is a river and stream water quality model that is intended to represent a modernized version of the QUAL2E (or Q2E) model (Brown and Barnwell 1987). Q2K is similar to Q2E in the following respects:

- One dimensional. The channel is well-mixed vertically and laterally.

- Steady state hydraulics. Non-uniform, steady flow is simulated.

- Diurnal heat budget. The heat budget and temperature are simulated as a function of meteorology on a diurnal time scale.

- Diurnal water-quality kinetics. All water quality variables are simulated on a diurnal time scale.

- Heat and mass inputs. Point and non-point loads and abstractions are simulated.

The QUAL2K framework includes the following new elements:

- Software Environment and Interface. Q2K is implemented within the Microsoft Windows environment. It is programmed in the Windows macro language: Visual Basic for Applications (VBA). Excel is used as the graphical user interface.

- Model segmentation. Q2E segments the system into river reaches comprised of equally spaced elements. In contrast, Q2K uses unequally-spaced reaches. In addition, multiple loadings and abstractions can be input to any reach.

- Carbonaceous BOD speciation. Q2K uses two forms of carbonaceous BOD to represent organic carbon. These forms are a slowly oxidizing form (slow CBOD) and a rapidly oxidizing form (fast CBOD). In addition, non-living particulate organic matter (detritus) is simulated. This detrital material is composed of particulate carbon, nitrogen and phosphorus in a fixed stoichiometry.

- Anoxia. Q2K accommodates anoxia by reducing oxidation reactions to zero at low oxygen levels. In addition, denitrification is modeled as a first-order reaction that becomes pronounced at low oxygen concentrations.

- Sediment-water interactions. Sediment-water fluxes of dissolved oxygen and nutrients are simulated internally rather than being prescribed. That is, oxygen (SOD) and nutrient fluxes are simulated as a function of settling particulate organic matter, reactions within the sediments, and the concentrations of soluble forms in the overlying waters.

- Bottom algae. The model explicitly simulates attached bottom algae.

- Light extinction. Light extinction is calculated as a function of algae, detritus and inorganic solids.

- pH. Both alkalinity and total inorganic carbon are simulated. The river's pH is then simulated based on these two quantities.

- Pathogens. A generic pathogen is simulated. Pathogen removal is determined as a function of temperature, light, and settling.

United States Environmental Protection Agency