SEDIMENT BASIN DESIGN

Applying Stokes's Law to enhance the dewatering process

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"...THE BEST QUALITY WATER—FROM A SUSPENDED SEDIMENT PERSPECTIVE—MUST BE LOCATED AT THE TOP OF THE WATER COLUMN..."

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Sediment basins are used on earth disturbance sites to minimize the amount of sediment leaving a site and entering surface waters. Sediment leaving a basin has been reduced by positioning the principal spillway to dewater the basin from the water surface and extending the total time for dewatering.

Perforated-riser and single-orifice principal spillways cause a sediment basin to capture about 80 percent of the silts and clays suspended in the captured runoff water. This assumes that essentially any sands and gravel entering the basin will settle near the basin inlet and be captured. Most sands and gravel are never transported to the basin and remain on the earth disturbance site.

The scientific principle that makes it possible to remove suspended sediment from runoff water is gravitational settling, governed by Stokes's Law. Stokes's Law yields a settling velocity for any suspended soil particle based on the particle's diameter and density and the water's viscosity, which is a function of water temperature. Stokes's Law assumes there is no turbulence in the water (quiescence).

An understanding of Stokes's Law helps us to realize that, under quiescent conditions, all suspended soil particles are moving downward in the water. If this is true, then the best quality water—from a suspended sediment perspective—must be located at the top of the water column in the impoundment.

Realizing that perforated risers and single orifices dewater a sediment basin from one or more locations spaced throughout the total water column, J. Warren Faircloth, an erosion control technician for Orange County, N.C., began the process of developing a dewatering device that would extract the highest quality water from a basin for delivery to the uncontrolled environment.

This effort started with a 5-gal bucket tied as a float to a piece of PVC pipe that collected the water. After many improvements over more than 20 years, the Faircloth Skimmer has emerged as a quality sediment basin dewatering device. The skimmer consists of six functional parts:

1) A closed PVC pipe shaped into a "C" that is the buoy that floats on the water surface; 2) An arm that carries the collected near-surface water from the water-entry point to the basin outlet near the bottom basin; 3) A water-entry unit suspended horizontally under the floating "C" that serves as a screened entry point for the collected water; 4) A control orifice located inside the water-entry unit and on the entry-end of the arm, which can be sized to control the basin outflow rate; 5) A vent tube that maintains atmospheric pressure on the downstream side of the control orifice; and 6) A flexible connecting hose that connects the exit end of the arm to the basin's barrel.

Research confirmed that the skimmer's setup would effectively control the dewatering of sediment basins and, in doing so, improve the sediment capture ability of the basin. SWS

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