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Application Note

Employing Best Monitoring Practices to Reduce Runoff during Construction

Real-time Continuous Monitoring Captures Episodic Events and Reduces Project Downtime

Under proposed EPA stormwater runoff guidelines, construction site operators will be required to actively monitor or sample stormwater discharges daily. The enhanced effluent rules take effect in August 2011 for construction sites that disturb 20 or more acres and February 2014 for sites that disturb 10 or more acres, and they may stipulate a strict numerical limit of less than 280 NTU for average turbidity (sediment in water) on any day.

As site managers know, capturing runoff events with traditional water sampling methods can be challenging. Real-time continuous monitoring provides a great solution for capturing episodic runoff events that sampling might miss. Additional benefits of real-time continuous monitoring can include reduced project downtime, prevention of fines, and project incentives.

Impact of Sediment Runoff

Sediment runoff occurs when storms wash sediment into streams, rivers, estuaries, and oceans. Pollutants can also be carried with the sediment, including nutrients, hydrocarbons, and heavy metals. The amount of natural sediment runoff can quickly be increased by human activity such as construction and through landscape changes, including: removal of natural buffer zones, agricultural activities, and use of impervious surfaces.

Several small sources of sediment runoff can add up to a larger, cumulative issue. Ultimately the increased sediment/pollution load can result in negative impacts to water and ecological health by causing:

- Decreased light attenuation, which can kill submerged aquatic plants
- Siltation of benthic habitat
- Initiation of algal blooms, some of which may be harmful, and
- Decreased dissolved oxygen, which can be stressful or deadly to aquatic organisms

Water quality monitoring station installed by stream provides continuous data during construction project.

Contractor checks YSI water quality sonde at one of 63 monitoring locations set up around a large highway construction project.

Monitoring Sediment Runoff during Construction

Monitoring sediment runoff during construction projects can be challenging. Storm events, which often create the largest amount of sedimentation, are very episodic and largely unpredictable. Episodes can occur in a span of a few hours and often at inopportune times, such as the middle of the night. Timing a response to the events in order to collect water samples is often problematic.

We've found that continuous monitoring, rather than sampling, can capture the episodic events more effectively. Continuous monitoring provides automated, around-the-clock data collection to identify if water quality problems are occurring as a result of construction activities. Chris Heyer, YSI Sales Representative, notes, "Real-time monitoring with alarms and alerts can serve as an early warning tool for potential Erosion Sedimentation Control (ESC) and Best Management Practices (BMP) failures. Ultimately, the continuous monitoring can prevent project downtime and regulatory fines—up to $32,500 per day, and in some cases can lead to incentives."

Building the Maryland Intercounty Connector

The Intercounty Connector (ICC) is a major highway construction project in Maryland that has successfully implemented real-time continuous monitoring at multiple stream crossings throughout the construction area. The ICC links existing and proposed development areas between the I-270, I-370 and I-95 corridors in Montgomery and Prince George's Counties with an 18.8-mile long east-west highway that limits access and accommodates the efficient movement of passengers and goods across six lanes.

continued

The highway's design helps restore the natural environment from past development impacts in the area. Highway and transportation agencies have taken great effort to avoid and minimize environmental impacts. One of the most sensitive issues was the potential impact of construction upon streams —and upon stream dwellers, such as the Eastern box turtle and brown trout. In response, the Maryland Department of the Environment established standards for several water quality parameters for each stream. The project has tight turbidity thresholds that must not be exceeded: Instantaneous Maximum of 150 NTU (well below the EPA limit of 280) and Maximum Monthly Average of 50 NTU.

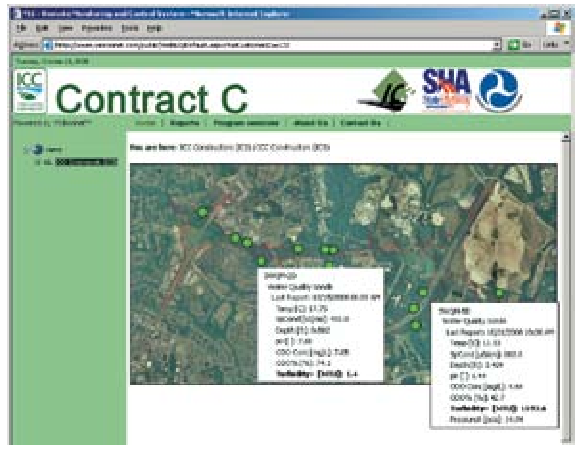
Turbidity Monitoring

The ICC project traverses eight watersheds, including three special protection areas. Sixty-three real-time, continuous water quality monitoring stations have been established upstream and downstream of construction activities throughout the entire area. For a portion of the ICC (Contract C) Skelly & Loy, a constructor design/build member for the ICC project, selected YSI Inc. equipment and installation expertise to meet the rigid water quality monitoring and data reporting requirements.

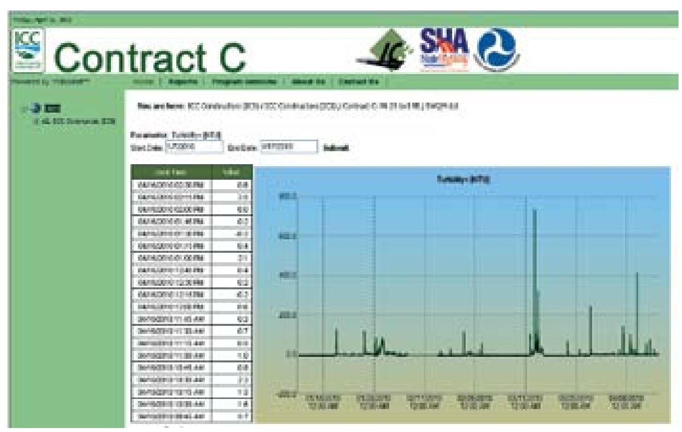
Each monitoring station in Contract C consists of a YSI multiparameter water quality sonde and telemetry. The sonde has sensors which measure turbidity, pH, dissolved oxygen, temperature, conductivity and water level. The instrument meets the standard methods set by the EPA for NPDES monitoring. A YSI EcoNet telemetry unit delivers data from the remote monitoring sites to project partners, who have immediate access to the water quality data through the Internet. Real-time alarms are programmed to notify key personnel of potential ESC and BMP issues, allowing them to rapidly respond and make necessary corrections.

For example, real-time continuous monitoring saved Skelly & Loy time and money in April 2010 during an intense four-hour rain event. High turbidity levels (>400 NTU) were recorded at one monitoring station which was close to the construction site at I-95. This station was situated upstream, near a private development with large areas of impervious surface. Key personnel were notified by email of the increased turbidity levels and were directed to investigate specific locations, saving them time. Once on site, they observed that the turbidity levels outside the limit of disturbance were greater than levels downstream of the construction area (<10 NTU). The continuous monitoring data indicated that the turbidity was not caused by construction activities, which contained most of the stormwater runoff in settling ponds, but instead by runoff from the developed area outside the construction zone.

"Real-time monitoring during this storm helped our construction managers verify that our BMPs were working properly. Consequently, we were not given a Notice of Violation fine because we demonstrated that the increase in sediment was not caused by our work but by an environmental factor outside our control," notes Bob McClure, Exec. VP of Environmental Services at Skelley & Loy. In other situations, real-time monitoring and alerts could help managers quickly troubleshoot inadequate erosion control measures, such as silt screens or buffers, to control sediment load during storm events.



Above: Data from water quality monitoring stations can be viewed in real-time via the web.
Below: Rainfall and subsequent runoff into stream created a turbidity spike captured by real-time monitoring.



Turbidity and Total Suspended Solids

Total suspended solids (TSS) concentrations and turbidity measurements both indicate the amount of solid particles suspended in the water, whether mineral (e.g., soil or clay particles) or organic (e.g., algae). A TSS test measures an actual weight of solids per volume of water, while turbidity measures the amount of light scattered from a sample (more suspended solids cause greater scattering). Turbidity values can be obtained on site and in real time while TSS values have to be calculated in the lab.