Performance Evaluation of Erosion and Sediment Control Practices Used during Earthwork Construction

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More than 75% of Iowa's waterbodies are listed as impaired or partially impaired, limiting the ability of the waterbodies designated uses for recreation, aquatic life, consumption, and navigation. Nonpoint source impairments are largely sourced from agricultural and urban pollutants, but also construction activities. Due to the nature of linear construction, earthmoving and grading activities cause rapid disruption of stabilized lands, leaving sites susceptible to erosion and increased risk of degrading stormwater runoff quality. Flows over unprotected land can suspend and transport sediment, which serves as a vessel for several pollutants; the United States Environmental Protection Agency (USEPA) identifies sediment as a widespread pollutant among nutrients and heavy metals, which cause significant physical, chemical, and biological implications. Stormwater management is becoming increasingly important in the United States, especially in construction activities. The National Pollutant Discharge Elimination System Construction General Permit (NPDES Permit) requires developers to employ stormwater pollution prevention plans (SWPPPs) for any construction activities larger than one acre in disturbance. The SWPPP is a comprehensive plan for the design, installation, and maintenance of erosion and sediment control (E&SC) practices used on site. E&SC practices are implemented throughout construction phasing to reduce sediment impairments in stormwater discharge.

This research study, funded by the Iowa Department of Transportation, evaluates the performance of commonly used structural E&SC practices (i.e., silt fence, sediment basins, check dams, etc.) for reduction of sediment transport on earthwork construction sites. Data collection includes automated sampling to collect water samples for analysis of turbidity and total solids and surveying to assess sedimentation capabilities and structural integrity of each practice. The first monitored practice was a temporary sediment control basin (installed per Iowa DOT EC-601). Sampling occurred over four weeks and included seven significant rainfall events. Turbidity and total solids analysis was conducted for samples at the inflow and discharge of the basin and plotted against the hyetograph. After consecutive rainfall events, effluent discharge sampling showed higher turbidity and total solids than at samples taken at the inflow of the basin, indicating negative treatment. The current design likely allows resuspension of previously settled particles and introduction of sediment due to sloughing basin walls. Modifications proposed for future testing include geotextile lining, baffles, surface skimmer dewatering system, and upstream rock check dam. This presentation will discuss continued research findings and analysis on the performance of common E&SC practices used on construction sites.

Keywords: Erosion; Sediment Control; Stormwater; SWPPP