American Water Resources Association
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Monday, Nov. 9
10:30 AM – 12:00 Noon
SESSION 3: Impacts of Land Use Changes

Impact of Residential Soil Disturbance on Infiltration and Runoff - Christopher Woltemade, Shippensburg University, Shippensburg, PA

Soil disturbances such as excavation, compaction, and addition of fill material in residential developments may affect rates of lawn infiltration and storm water runoff. Rainfall-runoff models applied to urban storm water management are commonly based on assumed infiltration rates, either representing undisturbed soils (pre-development conditions) or assumed conditions of soil disturbance. Sensitivity analysis of the NRCS curve number method for estimating storm runoff from residential areas indicates highly variable results depending on how residential soil conditions are incorporated in curve number estimates. Alternative curve numbers used to represent different assumptions of residential soil disturbance in Pennsylvania generate runoff estimates that vary by over 150% for a 2-year storm and by over 50% for a 100-year storm. This wide range of runoff estimates indicates a need for field testing of residential soil infiltration rates to support more accurate development of curve numbers to represent disturbed soil conditions. Accordingly, infiltration was measured using a double-ring infiltrometer at 120 sites near Shippensburg, Pennsylvania. Sites were selected to include four common soil series classified in hydrologic soil groups B and C. For each soil series, three locations were tested on each of 8 residential lots and 2 undeveloped agricultural sites, for a total of 96 residential and 24 agricultural infiltration tests. Agricultural infiltration rates represent the pre-development condition and were compared to generic rates for the corresponding hydrologic soil group and to the post-development (residential) infiltration rates. NRCS curve numbers were then developed for the residential areas based on the field-tested residential soil conditions and compared to curve numbers based on standard assumptions. Runoff amounts were simulated for 24-hour design storms ranging from the 2-year event (2.38 inches) to the 100-year event (6.95 inches). Model results document the magnitude of possible error from neglecting soil disturbance or applying generic assumptions without local field data.

Developing Methodology to Evaluate Urbanization's Effects on Watersheds - Tammy Parece, Virginia Polytechnic Institute and State University, Blacksburg, VA

Urbanization alters watersheds and, in many cases, the alterations adversely affect the watershed and its waterbody. The alterations are multifaceted and range from changing the size of the watershed to changing the quality of the water flowing within the watershed. Understanding how changes affect the health of the watershed is important in determining how to correct the detrimental effects of urbanization. Changes to watersheds are established in many ways. Geographic Information Systems along with remote sensing using aerial photographs, LIDAR and other forms of satellite imagery are frequently used when researching physical changes, such as land cover and impervious surfaces. Conclusions reached using these forms of analysis contain some uncertainty. In some cases, this uncertainty is decreased by comparing data with a random sample of specific site field visits. These analyses are beneficial for documenting changes over time. However, the impacts these changes have on watersheds are difficult to analyze without a comprehensive field comparison to the digital data. Additionally, ground analyses are conducted on specific portions of a watershed to determine the best practices in development of the locale, for handling issues such as flooding or to determine the health of a waterbody. The analyses are completed on that specific portion of the watershed, without taking into account the impacts on the entire watershed or higher order watersheds. These analyses are conducted in real time without the benefit of the knowledge of the watershed's history. Doing a combination remote analysis along with a comprehensive field analysis is a daunting task when considering costs and time involved. However,

without such an analysis, future evaluations on watersheds can only assume the watershed's history and this assumption places greater uncertainty in efforts to overcome adverse alterations already existing. Such task is the focus of a research project at Virginia Tech University. Developing the methodology incorporating both field work and remote analysis in a cost and time effective way is an integral part of the project. As part of this paper, the research's successes, failures and future avenues for investigation and analysis will be discussed.

Impact of Land Use Changes on Water Quality in Northern Georgia - Jun Tu, Kennesaw State University, Kennesaw, GA

A study of water quality, land use changes, and population growth trends in several watersheds of northern Georgia since the 1970s has been conducted to examine the relationships between land use changes and water quality through GIS and statistical analyses. GIS analyses are used to delineate sub-watersheds using Digital Elevation Models for water sampling sites and to derive land use indicators such as forest, agricultural land, residential use, and population density for each sub-watershed. Statistical analyses are used to examine, quantify, and compare the relationships between water quality parameters and land use indicators and to find good predicators of water quality changes in response to the spatial and temporal variations of land use patterns. Results from this study will contribute to a better understanding of the impact of long-term land use changes caused by urban sprawl on water quality.