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Session 2B

Kentucky Water Resources Research Institute, University of Kentucky

WATERSHED BASED PLANNING IN THE UPPER EAST FORK OF CLARKS RIVER

Maggie Morgan
Jackson Purchase RC&D Foundation, Four Rivers Basin Team, Strand Associates, Inc.
5514 Reidland Road
Paducah, KY 42003
(270) 908-4545
maggie.morgan@jpf.org

In May of 2005, the Kentucky Division of Water (KDOW) approved a project for watershed based planning in the Upper East Fork of Clarks River to be performed by the Jackson Purchase RC&D Foundation, Inc. (JPF). The KDOW agreed to match 60% of the total project cost, approximately $108,000. JPF provided the remaining 40% of the project cost, approximately $72,200. Portions of this watershed are listed on Kentucky's current 303d list of impaired streams. Contaminants of concern in this watershed include pathogens, siltation, organic enrichment/low dissolved oxygen, and nutrients. The goals of this project include the improvement of habitat and water quality in the Clarks River watershed, and the reduction of nonpoint source pollution from all sources in both the tributaries and the main stem of Clarks River.

Environmental data collection was performed throughout the entire East Fork Clarks River and West Fork Clarks River watersheds to determine threats to water quality in the watershed, locate sources of impairment in the watershed and determine the causes of these impairments. Sampling locations were determined by Strand Associates, Inc. (SA), an engineering firm providing technical support to the project, and the Four Rivers Basin Team (FRBT), a group of representatives from nonprofit organizations, local governments, private corporations, and state and federal agencies. Dry weather sampling was conducted to determine baseline conditions for the watershed. Baseline data indicated high levels of *E. coli* contamination, high baseline temperatures in some areas of the watershed, low dissolved oxygen levels in some areas of the watershed, and low natural alkalinity levels in some areas of the watershed. Three wet weather sampling events were conducted at six sites to determine pollutant load rates in the watershed and potential sources of pollutants. These sampling events indicated significant spikes in *E. coli* levels and total suspended solid (TSS) concentrations during rainfall events.

Environmental data collection identified four main pollutants of concern, *E. coli*, TSS, nutrients, and temperature. The final Watershed Based Plan for the East Fork Clarks River identified critical areas in the watershed where best management practices should be implemented to reduce pollutant load rates, thus improving water quality in the watershed. Best management practices identified by SA and the FRBT include vegetated buffer strips, erosion control practices, soil testing and precision agriculture, animal waste management, removal of straight pipes, maintenance of septic systems, fencing livestock away from streams, and the construction of wetlands. The specific best management

practices to be implemented in the watershed will depend on the area of interest, main pollutants of concern, and immediate local source of the pollutants.

This project also included an educational component provided by the Calloway County Conservation District. As part of this component, representatives from the Calloway County Conservation District worked with students from Murray High School and Calloway County High School to stress the importance of clean water, identify problems in their watershed, and identify ways these problems can be addressed.

With strong local support and a plan of action for moving forward, this project is an excellent example of local communities coming together to protect and enhance their local waterways.

KENTUCKY INSTITUTE FOR WATERSHED MANAGEMENT SUPPORT

Alanna Storey, Jana Fattic, and Andrew Ernest, Ph.D, P. E., DEE
Center for Water Resource Studies
Western Kentucky University
1906 College Heights Blvd #11075
Bowling Green, KY 42101-1075
Phone: (270) 282-1170
Email: alanna.storey@wku.edu

The Center for Water Resource Studies (CWRS) at Western Kentucky University (WKU) has established the Kentucky Institute for Watershed Management Support (KIWMS) for the purpose of providing regional planning support to communities throughout the Commonwealth in order to maintain the natural and economic resources of their watersheds. The CWRS expanded its scope of services, leveraging on existing expertise as a water, wastewater, utility and municipal technical assistance provider, to assist communities with realizing the fundamental goal of holistic watershed management. The vision is for KIWMS to leverage synergy between local, state and other resource agencies at a watershed level by providing infrastructure and support for accountability and the technical basis to ensure measurable results.

KIWMS will connect local communities with regional planning entities to achieve local change that positively impacts watershed health. A key strategy in the community-specific implementation of the KIWMS is a public education campaign. KIWMS will promote strategies for wastewater minimization for both residential and commercial establishments. KIWMS will also provide technical, financial and managerial assistance to develop and implement functional and extensible wastewater management alternatives for communities throughout Kentucky to improve watershed health and promote economic development. This assistance will be provided through detailed situation assessments, technology demonstrations, public education, and technical, managerial and financial alternatives. The techniques developed and resources accessed to further wastewater minimization strategies will be transferable to other project areas.

KIWMS will focus on the community of Glendale, Kentucky (population 1,800) as a demonstration of the way in which stakeholders at the local and regional level will be engaged in a collaborative problem solving process to develop sustainable and technically sound solutions for pervasive failures in onsite wastewater systems that potentially contribute to the pathogen impairment of the neighboring Valley Creek segment and limit the community's economic growth. The CWRS has been actively engaged with the Glendale Merchants Association, the Hardin County Planning and Development Commission, and Hardin County Water District #2, to develop technological and management alternatives.

NOTES

OVERVIEW OF THE TMDL DEVELOPMENT FOR PANTHER CREEK AND LONG FALLS WATERSHEDS IN DAVIESS AND MCLEAN COUNTIES, KENTUCKY

Josh Brewer
Center for Water Resource Studies, Western Kentucky University
1906 College Heights Blvd., Bowling Green, KY 42101
270-745-5287
josh.brewer@wku.edu

The Total Maximum Daily Load (TMDL) Development for the Panther Creek and Long Falls Watersheds is an ongoing water quality project where the Kentucky Division of Water (KDOW) and the Center for Water Resource Studies (CWRS) at Western Kentucky University work together to accomplish the requirements for the KDOW TMDL Program, Annual Work Plan under Section 106 of the Clean Water Act. KDOW is responsible for coordinating the overall project, collecting and identifying biological samples, determining Aquatic Life Use and review of all data prior to Environmental Protection Agency (EPA) submission. CWRS will be responsible for all daily activity including: project management, data sampling and analysis, data modeling, modeling reports, quarterly progress reports and development of TMDL documents. Once the project is complete CWRS will also address all questions from EPA, KDOW and the Public.

This overview will include discussion of the public meetings held, data collection, analysis and current modeling for TMDL development. This project involves selected impaired stream segments in the Panther Creek and Long Falls Creek watersheds in Daviess and McLean Counties, KY. All impaired water bodies are listed on the 2004 303(d) List of Waters for Kentucky, except for the pathogen impairment on South Fork Panther Creek river miles 13.5 to 17.7 which is in the Assessment Database as nonsupport and will be on the 2006 303(d) list. Impaired streams are listed for pathogens, pH, total dissolved solids (TDS), sulfates, organic enrichment (sewage) biological indicators, metals (copper), phosphorus (total), and nitrogen (total), and are not meeting the Designated-Use Criteria for Primary Contact Recreation (Swimming) and/or Aquatic Life.

NOTES

NITROGEN ISOTOPES TO STUDY THE VARIABILITY OF SEDIMENT TRANSPORTED FROM A LOWLAND WATERSHED IN THE BLUEGRASS

Jimmy Fox
Assistant Professor
Department of Civil Engineering
University of Kentucky
161 O. H. Raymond Bldg.
Lexington, KY 40506-0281
Phone: (859) 257-8668
Email: jffox@engr.uky.edu

Charles Davis
Hydraulic Engineer
WEST Consultants, Inc.
8950 South 52nd St., Suite 210
Tempe, AZ 85284, USA
Phone: (859) 806-3219
Email: chuck.davis.ky@gmail.com

Joseph Russo
Research Associate
Department of Civil Engineering
University of Kentucky
161 O. H. Raymond Bldg.
Lexington, KY 40506-0281
Phone: (859) 257-4093
Email: joseph.russo@uky.edu

Darren K. Martin
Research Associate
Department of Civil Engineering
University of Kentucky
161 O.H. Raymond Bldg.
Lexington, KY 40506-0281
Phone: (859) 257-4093
Email: dkmart2@uky.edu

Stable isotope ratio mass spectrometry was used to measure the nitrogen isotopic signature of transported sediment particulate organic matter at different spatial locations and for a 27 month period in a lowland watershed with pronounced temporary storage of fine sediments in the stream channel. The research worked to fill a need to assess the temporal and spatial variability of the biogeochemical sediment tracers for sediment transport source and fate studies at the watershed scale. We assessed the hypothesis that the nitrogen isotopic signature varies seasonally due to the interaction of biogeochemical

processes within sediment storage deposits in the bed of the stream and hydrologic processes impacting the suspension of sediments in the dynamic bed.

Sediment sources were characterized and thereafter sampled in the South Elkhorn Watershed, a lowland watershed in the Bluegrass Region of central Kentucky with pronounced streambank erosion and fine sediment storage. Samples were analyzed using stable isotope ratio mass spectrometry. The nitrogen isotopic signature of the streambed sediments was found to be significantly different than the banks and supported the hypothesis that the isotopic signature of the streambed reflects biogeochemical processes including accumulation and decomposition of organic matter and growth of microorganisms and benthic algae.

Weekly samples of transported sediments were also collected from the South Elkhorn using *in situ* sediment trap samplers from March 2006 to June 2008 at different locations in the watershed. Bulk sediment-water samples collected from the traps were prepared in the laboratory to isolate the fine fraction of sediment with particle diameter less than 53 μm and then further prepared and analyzed for their nitrogen isotopic signature on the stable isotope ratio mass spectrometer. Transported fine sediments collected from seven in-stream sampling stations showed longitudinal variability of the nitrogen isotopic signature reflecting the increased proportion of streambank erosion lower in the watershed. The time-series of the nitrogen isotope was analyzed for a mean/seasonal trend and compared with water temperature data as well as the timing of significant hydrologic events that have been found to transport sediments in the watershed. The results support the idea that during transport of sediments from the watershed, the nitrogen isotopic signature of sediment particulate organic matter varies seasonally and that the enrichment and depletion of the isotopic signature is reflective of organic matter decomposition and accumulation in the streambed sediment deposits across seasons. The nitrogen isotope seasonal variability lags behind water temperature reflecting the interaction of the biogeochemical and hydrologic processes in the dynamic bed that includes temporary sediment storage and intermittent sediment flushing during a significant hydrologic event in the lowland watershed system.

The temporal results exemplified the conclusion that the nitrogen isotopic signature of transported fine sediments can vary considerably over seasons in lowland watersheds which should be accounted for when performing tracer studies to assess sediment source and fate in a watershed. After accounting for this variability, a mass balance un-mixing model analysis was performed to estimate the contribution of sediment from streambed and streambank end-members to the transported load throughout the basin and Monte Carlo sampling was included to assess the variability associated with the estimates.