

ROLLA WATER RESOURCES LUNCHEON SEMINAR

Thursday, October 21, 2010

11:45 a.m. - 1:00 p.m.

U.S. GEOLOGICAL SURVEY

1400 INDEPENDENCE ROAD

ROLLA, MO 65401

Hydropower Contributions to Mass Wasting Problem for the Osage River Below Bagnell Dam, Missouri

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The lower Osage River is a meandering stream which naturally erodes resulting in bank stability failures. Hydropower and flood control operations increase the occurrence of long-duration, high-stage flow events that may have an additional deleterious effect on bank stability. Additionally, any changes that occur in the watershed that increase the rate or volume of runoff may have supplementary deleterious effect on bank stability, such as, land use practices. Banks with low cohesion soils and erodible toes are particularly unstable and those with high cohesion soils and unerodible toes are most stable. Maintenance of high river flows or precipitation induced alluvial subsurface flows can cause bank saturation, creating positive pore-water pressures significant enough to promote instability. Also, rapid changes in flows that occur with peaking power operations may have affect on bank stability.

The action of the shear stress caused by flowing water on the erodible banks of the Osage River downstream from Bagnell Dam will be quantified to establish the Erosion Potential (EP). The practical determination of the Erosion Potential at selected river reaches requires knowledge of the flow conditions (e.g. hydrograph {stage or discharge}), soil composition of the stream banks (e.g. strata), and the erodibility of stream bank materials

The EP will be quantified along the Osage River with a numerical model hereafter called the Erosion Potential Model (EPM). The well-established mechanistic notion that flowing water generates shear stress on the channel boundary, and that, in turn, that shear stress causes erosion, dictates the structure of the EPM. The EPM consists of two uncoupled models, the Hydrodynamic Model (HEC-RAS) and the Erosion Data Viewer (EDV), that work in series.

The modeling effort was undertaken to determine the relative impact of hydropower operations on erosion in the Osage River downstream of Bagnell Dam. Ameren UE provided typical operational scenarios that are used as an input hydrograph to the modeling process. This hydrograph becomes input to the HEC-RAS hydraulic model (Mead and Hunt calibrated, Corps of Engineers, Kansas City District model) of the Osage River from which the slope of the energy grade line and water surface elevation is determined for each time increment. This information is then input to the Erosion Data Viewer program (EDV) which in turn computes the shear stress for each soil types that makes up the river bank. Once, the shear stress is known then the erosion rate is determined for that specific soil type to get the erosion rate. The erosion rate is multiplied by the time increment to get the erosion for that time interval. All the time intervals are summed to get the total EP. The EDV program output graphs, numerical EP totals, and totals for all reaches. By performing the above process for different scenarios one can make comparisons of EP for different conditions. Thus, allowing the determination of the impact of hydropower on the erosion Osage River downstream of Bagnell Dam.

Biography: Dr. Morris is an Associate Professor of Civil Engineering at Missouri University of Science and Technology. His considerable professional career has included positions in both the private and public sectors. Dr. Morris' expertise includes hydrology, hydraulics, urban hydrology, probabilistic analysis, hydraulic transient analysis, multi-dimensional flow routing, stochastic hydrologic modeling, water supply and flood control analysis, watershed modeling, hydraulic equipment, flow through porous media, sediment transport, and erosion.

---Next Luncheon---

John Schumacher, USGS

Water Quality at Lake of the Ozarks

Thursday, November 18, 2010 11:45 AM – 1:00 PM

Park in the USGS south lot (free parking) and enter the visitor entrance in the southwest corner of the building. For those of you attending the meeting from outside Rolla, you can find directions to the USGS Rolla Center at:

<http://mcmweb.er.usgs.gov/>. The Rolla Water Resources Luncheon is a Brown Bag Lunch event. For those unfamiliar with the area and disinclined to brown bag it, you can find take-out options offerings among the Rolla restaurants found at: <http://mcmweb.er.usgs.gov/rollamap09ext.pdf>