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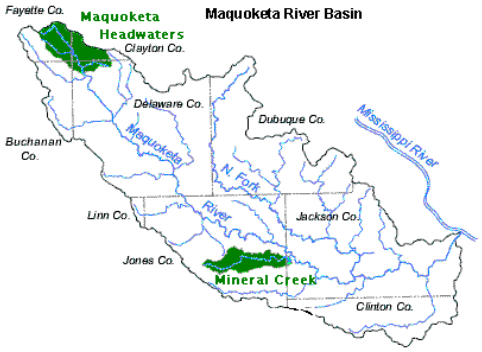
University Extension

On-Farm Monitoring of Nutrient Flow Through a Vegetated Filter Strip

Water Quality Integrated Research, Education and Extension



In subwatersheds of the Maquoketa River Basin in northeast Iowa, Iowa State University Extension is providing facilitation for citizens' watershed councils and for integrated research, extension and education programs related to management of agricultural impacts on water quality.

Farmer-Driven Research. In the Maquoketa Headwaters watershed the owners of CJ Farms wanted to know the effectiveness of a vegetated filter strip (VFS) in removing nutrients from post-settling effluent of their 800-head beef feedlot. This study demonstrates how project staff tied to a land grant institution can leverage resources for watershed residents in the form of research scientists' involvement. Designed in response to local concerns, the research is providing information useful to livestock feeders throughout northeast Iowa and surrounding states.

Project support has been 'bootstrapped' from many sources. Extension water quality project staff are the primary land- owner contacts. An Extension Field Specialist designed the VFS and the owners paid for construction. The ISU Iowa Beef Center funded installation of tile lines to monitor subsurface drainage. ISU Department of Agricultural and Biosystems Engineering scientists designed monitoring for N and P in runoff, subsurface drainage and soils. Soil cores were taken by ISU scientists and by project staff assisted by NRCS. The USDA CSREES 406 program funded installation of a flume at the outflow, and two stage recorders. The Iowa Department of Natural Resources supported two years' monitoring, beginning in April, 2001.

Preliminary results: Summary 2001 data and a schematic of the VFS are shown on page 2. Three of five rainfall events resulted in outflow from the filter strip. Overall 92% of inflow plus precipitation was retained. The main factor in reducing mass nutrient transport in inflow relative to outflow was infiltration reducing the volume of outflow. Nutrient concentrations [NH_4-N, TKN (fil.),TKN (unfil.), PO_4-P (fil.) sol-P (fil.) and total-P (unfil.)] in surface flow varied over a factor of 3 to 5 depending on the rainfall event.

Nutrient concentrations were measured from five monitoring wells beneath the site on five dates in 2001. Well 4 appeared to have a direct connection to the surface, either through location in a sand lens, or due to a short-circuit in construction. It was later excluded from the data. Although ammonia-N, NO_3-N, PO_4-P, and sol-P concentrations were higher in this well than the others, they were still lower than the concentrations in the VFS surface inflow and outflows. The other four wells exhibited much lower nutrient concentrations.

Subsurface (tile) drainage through the site is also monitored. In 2001, NH4-N, PO4-P and sol-P increased in August and September, possibly in response to inflow events. NO_3-N concentrations were lowest when NH_4-N were highest. Concentrations of NH_4-N, PO_4-P, and sol-P were generally higher than research has shown for subsurface drainage from row-crop land, but still much lower than average inflow concentrations. Low NO_3-N concentrations in inflow, outflow, and well samples were probably due to slow nitrification. Even concentrations of NO_3-N in subsurface drainage, averaging 3.0 mg/L, were much lower than the 15-20 mg/L usually measured from row-crop land.

Impacts: The project has been praised for its timeliness and responsiveness to clients. Data have been used by a local group in developing an initiative on environmentally-sound manure management approaches for small cattle feedlots.

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CJ Farms Research/Demonstration Site: Monitoring of a Vegetated Filter Strip Receiving Feedlot Runoff

Summary of 2001 VFS Monitoring					
mg/l	Inflow average conc.	Outflow average conc.	Monitoring wells - ave.	Well # 4 (sand) ave.	Tile flow ave.
NH4-N	112	50	1.3	44	5.8
TKN (fil)	274	94			
TKN unfil)	441	162			
NO3N			0.8	0.1	3.0
PO4-P fil.	38.8	24.1	0.36	8.4	0.93
sol-P fil.	74.5	31.1	0.89	19.1	2.86
Tot.P (unfil)	138	52			
	6 rainfall events	3 rainfall events	4 wells, 5 sample dates	1 well, 5 sample dates	25 sample dates

Field day visitors view dispersion structure.