

# *Comparison of Water Quality in Four Small Watersheds Containing Animal Feeding Operations in Iowa, 1996-98.*

*Kent D. Becher<sup>1</sup> and Kimberlee K.B. Akers<sup>2</sup>*

Agriculture constitutes 93 percent of all land use in Iowa, and Iowa leads the Nation in the production of hogs. Within many watersheds in Iowa, the number of animal feeding operations (AFOs), such as large-scale hog confinement facilities, has doubled in the past several years. A typical hog produces two to five times the waste as a human. Thus, the large number of facilities in some watersheds can produce as much untreated waste as a large city (100,000's to millions of people). There are concerns that large confinement facilities may have a negative impact on the water quality. AFOs may add to the overabundance of nutrients that are already introduced into the environment from chemical fertilizer, atmospheric deposition, soil mineralization, and municipal discharge. In addition, manure spills cause fish kills and introduce large loads of nitrogen and phosphorus directly into the waterways that drain to the Mississippi River. Excessive nutrients can cause water-quality problems such as excessive algal growth, taste and odor problems, health effects in humans, and have been linked to the phenomena called hypoxia (dissolved oxygen of less than 2 milligrams per liter) in the Gulf of Mexico.

The National Water Quality Assessment Program collected water-quality samples monthly from 1996 to 1998 at twelve locations in eastern Iowa. Four of the smaller watersheds were selected for comparison in areas where land-use practices are similar, but there are differences in the density of AFOs and the amount of estimated manure applied within the watershed. A Geographic Information System was used to delineate drainage basins, locations of large scale feeding operations, and manure inputs within each basin.

Concentration and yields of nutrients were compared between the sites using a Wilcoxon Rank sums test. There were statistical differences ( $p < .05$ ) in concentrations and yields between some of the sites. Concentrations were greater in high-density AFO watersheds than low-density AFO watersheds for dissolved ammonia and organic nitrogen, total ammonia and organic nitrogen, and organic nitrogen. Nutrient yields for total nitrogen, organic nitrogen, and total phosphorus were statistically greater in watersheds with higher AFO densities. However, high-density AFO watersheds did not always have greater concentrations for total nitrogen, dissolved ammonia, nitrate, nitrite, dissolved phosphorus, total phosphorus, and dissolved orthophosphate than low-density AFO watersheds. Differences in physiography, agricultural practices (for example, amount and timing of manure and chemical fertilizer application), soil type, soil slope, and precipitation could be attributed to some of the differences. The data reflect a very complex system that requires long-term water-quality monitoring to determine if these differences in water quality are directly related to AFOs. Many of the AFOs have only been operating for a few years. More time may be required before their effects are reflected in the water quality of these basins.

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<sup>1</sup>U.S. Geological Survey, Federal Bldg., Rm. 269, 400 South Clinton Street, Iowa City, IA 52240 ([kdbecher@usgs.gov](mailto:kdbecher@usgs.gov))

<sup>2</sup>U.S. Geological Survey, Federal Bldg., Rm. 269, 400 South Clinton Street, Iowa City, IA 52240 ([kkakers@usgs.gov](mailto:kkakers@usgs.gov))