

Title: A Field Evaluation of Drainage Ditches as Barriers to Contaminant Migration (Study No. 55)

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Period of Contract: November 16, 1989 through September 30, 1990

Objectives: To evaluate the effectiveness of drainage ditches as barriers to groundwater flow and as a prevention of the spread of agricultural chemical contamination.

Background/Need: Detections of significant concentrations of pesticides have resulted in the closing of municipal wells and the abandonment and deepening of domestic wells in the Central Sands Plain of Wisconsin.

Methods: A series of natural gradient tracer tests were conducted at a field site located in the northeast corner of Adams County, Wisconsin during the summer and fall of 1989. A variety of well types were installed at the field site to locate the water table, determine the direction of groundwater flow, evaluate vertical gradients and obtain samples at different levels within the aquifer. For each tracer test, a dilute solution of a conservative ion was injected into wells. Monitoring of tracer concentrations in downgradient wells allowed determination of groundwater flow paths.

Results: Tracer tests revealed that the effective capture depth of the ditch at the Adams County site is at least 14 feet below the water table. The shallower flow within the aquifer has a greater and more variable velocity than the deeper flow. The hydraulic conductivity of the shallow portion of the aquifer is approximately 50 to 130 feet per day. The parameters of the analytic solution are likely to vary independently in the physical system. The greatest source of uncertainty in prediction of the capture zone of ditches in the Central Sands Plains is the estimate of the ratio of horizontal to vertical hydraulic conductivity.

Conclusions: Drainage ditches should allow for effective removal of shallow groundwater contamination based on the capture depth of the dividing streamline. It may not be possible to approximate the flow field around the ditch with a two-dimensional model because the flow field has a three-dimensional, non-uniform nature and there are large transient variations in groundwater velocities.

**Recommendations/
Implications:**

Investigators suggest additional research towards improved definition of the groundwater flow field and the physical and chemical heterogeneities of the system. This information will improve the understanding of the movement and dispersion of the tracer and aid in continued evaluation of predictive tools.

Availability of Report:

This report is available for viewing and loan at:

The Water Resources Center
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Key Words:

Central Sands, drainage ditch, groundwater flow system, pesticides, tracers.

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