

## **Nitrate Contamination of a Bedrock Aquifer in Sheldon, Vermont: Part I, The Agricultural Context**

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In 2004, the Vermont Agency of Agriculture initiated a groundwater investigation in response to complaints that private, non-farm, drinking water wells were contaminated as the result of agricultural activities. The domestic wells of concern were located in the vicinity of a large dairy farm in NW Vermont. The primary concern as expressed by the well owners was bacteria and nitrate contamination from a manure storage pit. The potential sources of bacterial and nitrate contamination in the area included the manure storage pit, residential septic systems and manure/fertilizer applications to crop land used for the production of silage corn.

Well water sampling for nitrate, bacteria and herbicides indicated a distinct grouping of wells with nitrate-N concentrations that ranged from 9-24 ppm. Sampling results revealed a very abrupt transition between the group of wells with elevated nitrate concentrations and those wells with no nitrate detections. All the drinking water wells tested had no detections for bacteria or herbicides.

The course of the investigation has been conducted in partnership with the farm landowner/operator, the Vermont Geological Survey, the Vermont State Office of the USDA Natural Resources Conservation Service and the NRCS National Water Management Center. The investigation has included the following stages: **1)** continued sampling of farm and non-farm drinking water wells (2004-2008); **2)** re-inspection of the engineering design and permeability testing for the manure pit; **3)** installation of monitoring wells in a crop field adjacent to residential wells and manure pit (March 2005); **4)** survey and mapping of bedrock and surficial geologic materials and structures (October 2005); **5)** conduct EMI (electromagnetic induction) survey of soil water and bedrock profile of field crop and manure pit areas (May 2006); and **7)** installation of soil lysimeters based on results of EMI survey (May 2006).

Water sampling results and other investigation techniques indicate that agronomic field practices are the source of elevated nitrate in groundwater. In 2005, the Agency of Agriculture instituted a prohibition on the fall application of manure or fertilizer on 34 acres of crop land adjacent to the group of wells with elevated nitrate concentrations. The farm operator has continued to implement this revised nutrient management practice for the 2005-2008 cropping seasons. Improvement to the level of nitrate in groundwater as characterized by the soil lysimeter, monitoring well and drinking water well data is variable.

Water quality of the bedrock aquifer has not adequately responded to the current crop management practices. The Agency of Agriculture continues to conduct groundwater monitoring of both farm and non-farm wells and to work with the farm operator to adjust the farm's nutrient management plan for the crop production areas that are contributing to nitrate contamination of groundwater.