Idaho State Department of Agriculture
Division of Agricultural Resources

Ground Water Quality of Twin Falls County Volcanic and Sedimentary Aquifer

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Introduction

The Idaho State Department of Agriculture (ISDA) developed the Regional Agricultural Ground Water Quality Monitoring Program to characterize degradation of ground water quality from contaminants leaching from agricultural sources. The ISDA currently is conducting monitoring at eleven regions in Idaho with plans to implement further testing in other areas (Figure 1). The objectives of the program are to (1) characterize ground water quality related to primarily nitrate and pesticides, (2) determine if legal pesticide use contributes to aquifer degradation, (3) relate data to agricultural land use practices, and (4) provide data to support Best Management Practices (BMP) and/or regulatory decision making and evaluation processes.

The ISDA Twin Falls County Volcanic and Sedimentary Aquifer regional monitoring project began in 1998 as a result of previous monitoring by the Idaho Department of Water Resources (IDWR). Five water wells in Twin Falls County tested during the first round of IDWR's Statewide Ambient Ground Water Quality Monitoring Program, exceeded the Environmental Protection Agency Maximum Contaminant Level (MCL)[1] of 10 milligrams per liter (mg/L) for nitrate (Neely and Crockett, 1999). To establish this regional monitoring project, the ISDA randomly selected 75 domestic wells in the northern Twin Falls County area and coordinated with homeowners to conduct ground water sampling.

Nutrients, common ions, and pesticides were evaluated during the first two years (1998-1999) of ISDA's testing. Laboratory results indicated that numerous domestic wells in the area had nitrate concentrations just below 10 mg/L during the two-year period. One well tested had a nitrate concentration of 14.4 mg/L which exceeded the EPA health standard. In addition, low level detections of various pesticides were found in several sampled wells during the 1998 and 1999 testing periods.

[1] MCLs represent the EPA health standard for drinking water.

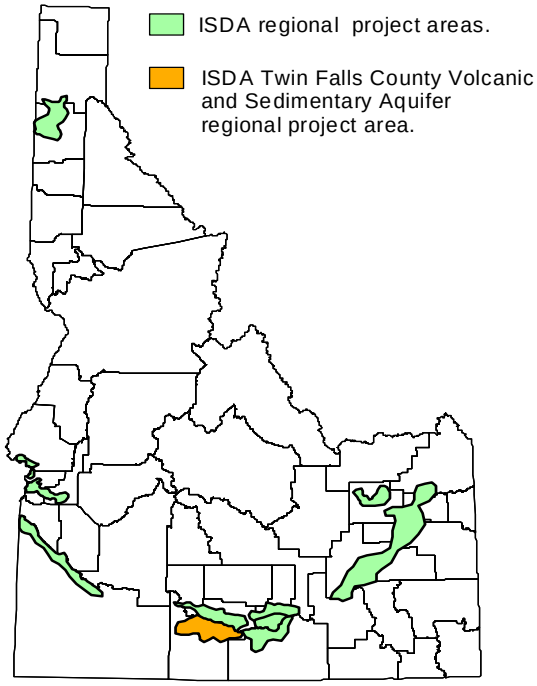

Figure 1. Location of Twin Falls County Volcanic and Sedimentary Aquifer regional project and other regional project areas.

The ISDA currently is working to advise residents and officials of the area to reduce further ground water contamination and possible health risks. Ground water monitoring will continue through the year 2002 to assist with these efforts.

Description of Project Area

The Twin Falls County Volcanic and Sedimentary Aquifer regional project encompasses an approximately 25 mile wide and 40 mile long area of northern Twin Falls County south of the Snake River (Figures 1 and 2). Irrigated crop land and dairy cattle operations are the two primary agricultural activities in the area.

Based on IDWR land use data, over 90% of agricultural lands within the project area are irrigated by gravity flow. Major crops in the area include alfalfa, grain, beans, potatoes, sugar beets, and corn (Idaho Agricultural Statistics Service, 1999). Approximately 89 dairies currently are in operation within Twin Falls County (Patton, 1999).

Surface or near surface basalt flows which offer potential paths for leaching of contaminants via fractures underlie northern Twin Falls County. Based on well drillers' reports from wells sampled as part of the project, depth to first ground water is variable ranging from about 10 feet to 300 feet below land surface. Drillers' reports indicate that the ground water aquifer is situated in fractured basaltic rocks with intercalated sands and gravels. Potential sources for nitrate leaching to ground water in the area include applied nitrogen-based fertilizers, septic systems, cattle manure, legume crops, and wastewater lagoons.

Results

Sampling results for the first two years of testing indicate nitrate and pesticide impacts have occurred to the aquifer

Results are summarized and presented in the following sections.

Nitrate

Results of ground water sampling in the project area from 1998 to 1999 indicate increases in both median nitrate levels and the number of wells testing above 5 mg/L for nitrate (Figure 2). In 1999, 40 or 53.3% of the wells sampled were over 5 mg/L for nitrate concentrations; a 12% increase from 1998 (Table 1). One well per sampling year tested (1998 and 1999) over the MCL for nitrate with concentrations of 13.3 mg/L and 14.4 mg/L, respectively. Median nitrate concentrations for 1999 were 5.2 mg/L; an approximate increase of 0.7 mg/L from the median concentration determined from 1998 testing results.

Wells showing elevated nitrate concentrations are dispersed throughout the project area (Figure 2). The increase in median nitrate concentrations from 1998 to 1999 and the number of detections over 5 mg/L are of concern because of potential health risk. (Table 1).

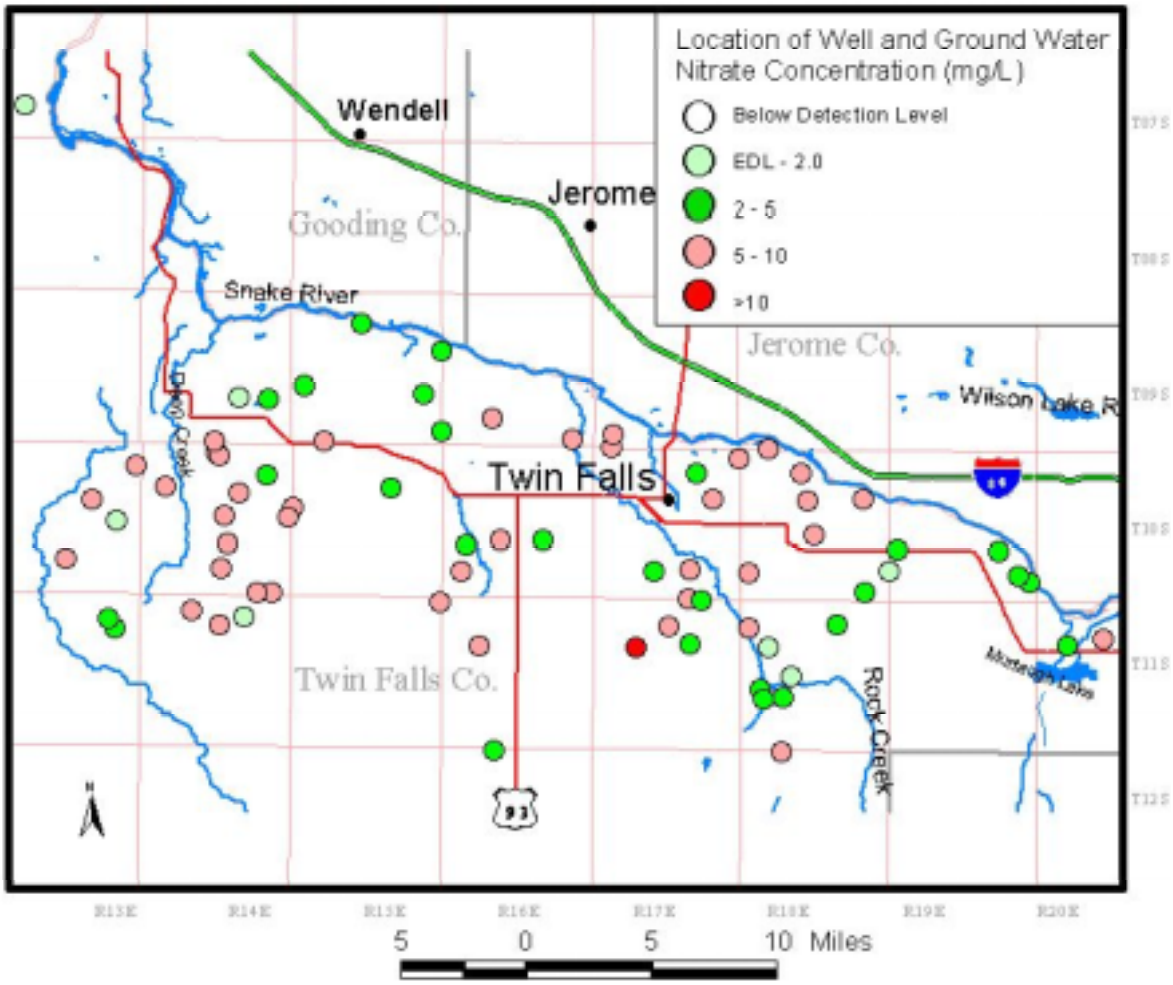

Figure 2. Locations of wells sampled by ISDA in Twin Falls County Spring 1999. Colors represent nitrate concentration measured in ground water from each well.

Table 1. Nitrate results for Twin Falls County Volcanic and Sedimentary Aquifer regional project, 1998-1999

Concentration Range (mg/L)	Spring 199875 wells	Spring 199975 wells
< EDL (0.033)	0(0%)	0(0%)
EDL to < 2.0	12(16%)	7(9.3%)
2.0 to < 5.0	31(41.3%)	27(36%)
5.0 to < 10	31(41.3%)	40(53.3%)
> 10	1(1.3%)	1(1.3%)
Median Value	4.5 mg/L	5.2 mg/L
Maximum Value	13 mg/L	14.4 mg/L

Pesticides

In 1998 and 1999, samples for all wells were sent to the University of Idaho Analytical Sciences Laboratory (UIASL) in Moscow, Idaho. Samples were tested for various pesticides utilizing EPA Methods 507, 508, and 515.1, and 531.1.

Pesticides were detected frequently throughout the project area. However, detections were typically low in concentration. Testing of ground water samples collected during 1998 and 1999 detected the presence of atrazine, dacthal, 2,4-DCBA, and diazinon in order of most to least frequently detected (Table 2 and 3). All pesticide detections, with the exception of 2,4-DCBA and diazinon, were below any health standard as set by the EPA or the state of Idaho.

In 1999, the two pesticides positively detected were atrazine (2) and dacthal (1) (Table 3). Wells showing concentrations above the EPA health standard for 2,4-DCBA and diazinon in 1998 were below laboratory detection limits for the two compounds in 1999.

Conclusions

Ground water within the volcanic and sedimentary aquifer of the project area is being impacted from nitrates and pesticides. Because of the number of nitrate detections near the MCL and the large number of nitrate detections overall, contamination of ground water by nitrate is of concern. Although concentrations are generally low, the frequency of pesticide detections also is of concern, in part, because of multiple pesticide detections per well. Health risks associated with consuming low level concentrations of more than one pesticide compound is poorly understood.

Median ground water nitrate levels have increased 0.7 mg/L from 1998 to 1999. In 1999, 53.3% of the 75 wells sampled were over 5 mg/L for nitrate. One well exceeded the EPA drinking water standard of 10 mg/L. Areas having highest nitrate concentrations are dispersed throughout the study area.

Numerous types of pesticides were detected in the project area. Although several wells showed concentrations above the EPA health standard for 2,4-DCBA and one for diazinon, these compounds were not detected in follow-up monitoring in 1999. For both years, atrazine and dacthal detections were the most common. In 1999, the number of detections were down with atrazine and dacthal being the only two pesticides detected.

Agricultural practices are likely a contributor to nitrate and pesticide detections in the ground water of this project area. Testing results indicate nitrate and pesticide impacts to ground water of the project area are widespread. Leaching of applied commercial fertilizers and animal waste are probably a major cause of nitrate entering the ground water.

Pesticide Detects	Number Detects (75 wells)	Range (µg/L)	Health Standard (µg/L)
Atrazine	14	0.014 - 0.2	3 (MCL)*
Dacthal	4	0.054 - 0.3	100 (RfD)**
Diazinon	1	0.41	.01(RfD)**
2,4-DCBA	4	0.1 - 17	.09 (RfD)**

Pesticide Detects	Number Detects (75 wells)	Range (µg/L)	Health Standard (µg/L)
Atrazine	2	0.032-0.036	3 (MCL)*
Dacthal	1	0.13	100 (RfD)**

Recommendations

To determine if current agricultural and pesticide application practices are contributing to ground water degradation and to locate other potential contaminant sources, the ISDA recommends continued and more intensive monitoring in the project area.

Testing should include, but not be limited to:

- Continued ground water monitoring for nutrients, common ions, and pesticides.
- Isotope testing to determine possible nitrate sources and relative ages of ground water.
- Soil sampling and soil pore water sampling.

The ISDA further recommends that measures to reduce nitrate and pesticide impacts on ground water be addressed and implemented. The ISDA recommends that:

- Growers and agrichemical professionals conduct nutrient, pesticide, and irrigation water management evaluations.
- Producers follow the Idaho Agricultural Pollution Abatement Plan and Natural Resources Conservation Service Nutrient Management Standard.
- Producers and agrichemical dealers evaluate their storage, mixing, loading, rinsing, containment, and disposal practices.
- Homeowners assess lawn and garden practices, especially near wellheads.
- Local residents assess animal waste management practices.
- State and local agencies assess impacts from private septic systems.
- Home and garden retail stores establish outreach programs to illustrate proper application and management of nutrients and pesticides.
- Responsible parties assess current pesticide application practices to non-crop areas (example: roadsides, railroad areas, etc.).

The ISDA recommends that the Balanced Rock, Snake River, and Twin Falls Soil and Water Conservation Districts lead a response process to create a plan of action to address these ground water contamination issues. The soil and water conservation districts should work with local agrichemical professionals, landowners, and agencies to implement this process and seek funding to support these efforts. The ISDA will support these local partners in seeking funding and implementing a comprehensive program.

References

Idaho Agricultural Statistics Service, 1999. 1999 Idaho Agricultural Statistics, 65p.

Neely, K. W., and Crockett, J. K., 1999. Nitrate in Idaho's ground water: Idaho Department of Water Resources Technical Results Summary No. 1, 12 p.

Patton, M., 1999. Personal communiqué. Idaho State Department of Agriculture, 2270 Old Penitentiary Road, Boise, Idaho 83712.