

Water Quality Issues in Nebraska¹

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The primary water quality issue in Nebraska at this time is related to groundwater as opposed to surface water. Groundwater provides irrigation for over 7 million acres of land in Nebraska and is the drinking water source for almost all of Nebraska's domestic and municipal water users. In rural areas groundwater provides about 85% of the drinking water (Cast, 1985). Numerous reports of groundwater contamination led to its emergence as a major environmental issue for the 1980's. Government agencies at the local, state and national level are becoming involved in the groundwater quality issue. The primary reason is public expression of more concern about the health implications of drinking contaminated groundwater.

This paper will address two general areas of water quality issues. The first will be those related specifically to Nebraska the second will be an overview of some of the federal legislation that is currently being introduced.

Irrigation Development in Nebraska

Nebraska has a very abundant supply of under ground water. Irrigation development in much of the Platte River Valley began in the late 1940's to early 1950's as furrow and flood irrigation. Introduction of center pivots expanded the acreage that was irrigated during the 1970's. Much of this development was on sandy soils, however, large acreages of finer textured soils that previously were to difficult to irrigate with furrow or flood methods were also brought into production. Much of this irrigated acreage is under row crops primarily corn. Center pivot irrigation provided an opportunity to add chemicals with the irrigation water. This method is used for incremental nitrogen application and is beneficial on sandy soils because it provides an effective means of splitting nitrogen application to improve nitrogen fertilizer use efficiency. During the last few years other chemicals, specifically insecticides and herbicides, have been injected through center pivots. There is growing concern about the possibility of many of these chemicals flowing directly back into the well and contaminating the groundwater.

Natural Resource Districts

A unique feature of the Nebraska governmental structure is Natural Resource Districts. They were created in the early 1970's by an act of

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the state legislature. They have taxation authority (mill levies) to generate budgets and are charged with proper development and conservation of the states natural resources and to implement policy passed by the legislature. NRD's are governed by a popular elected board of directors, usually producers in the NRD.

Department of Environmental Control

Nebraska has a Department of Environmental Control (DEC) which is similar to what may be termed a state Environmental Protection Agency (EPA). In 1981 the DEC proposed the development of a strategy for the protection of groundwater quality in Nebraska. The final report was issued in February 1985. The strategy stresses the protective measures that are needed to control or manage potential sources of groundwater contamination. Six potential sources of contamination were identified as the most serious threat to groundwater quality. They are (1) Chemical and fuel storage, (2) Agricultural chemicals, (3) Waste treatment and disposal areas, (4) Water wells and unregulated test holes, (5) Industrial facilities, and (6) Spills and leaks during transport of hazardous materials.

The strategies were developed for each of these different contaminants and a concept was introduced called Special Groundwater Quality Protection Areas. Under this concept the local efforts of towns, counties, or natural resource districts to protect groundwater quality would be tied to state authority (DEC) to regulate certain potential sources of contaminations. A special protection area of a given size and location would be designated within the state based on three criteria - (1) The vulnerability of an areas groundwater to particular types of contamination, (2) the presence or potential presence in an area of certain activities that pose significant potential for contaminating groundwater, and (3) the dependence of an area on the groundwater resource and the lack of practical or feasible alternative water supplies. Once a special protection area is designated the local government would be given the opportunity to develop and carry out their own measures for protecting the groundwater resource. The DEC would assist in identifying possible alternatives, would monitor the process and determine its effectiveness over time. If no local action were taken the DEC would then institute the protective measures in the area.

Groundwater Quality Legislation

Following this action two important legislative bills related to groundwater quality were passed and implemented beginning January 1, 1987 in Nebraska. The first is the Nebraska Chemigation Act (LB274). This act required any irrigator or applicator as defined in the Law to have certain specified safety equipment on any center pivot or any irrigation device that was used to inject any chemical into the irrigation water. Secondly, the applicator needed to be certified after going through a training period and passing a test. The NRD's had the task of inspecting the injection systems. The DEC contracted the Nebraska Cooperative Extension Service to provide the training.

The second bill that was implemented (LB894) was called the Groundwater Nitrate Bill. This bill provides for the establishment of special groundwater protection areas where nitrate nitrogen levels in the groundwater are increasing or have increased beyond certain levels.

Much of the activity and concern about groundwater nitrate in Nebraska has been in the central portion of the Platte River Valley. On a national level nitrate has received a good deal of attention because the drinking water standard for public water supplies is 10 ppm nitrate-nitrogen. As early as 1961 some fairly high levels of nitrate-nitrogen were found in groundwater in Merrick County, NE. A generalized survey that was done of the state of wells in 1962 provided a baseline for much of the later sampling work (Extension Service, 1962). The NRD's have provided much of the information for the well water sampling during the 1970's and 1980's. A graph of the nitrate level trends in the overall groundwater for three counties in the Central Platte District are shown in Figure 1. The concentrations of nitrate nitrogen are increasing in the areas that are affected.

NITRATE LEVEL TRENDS

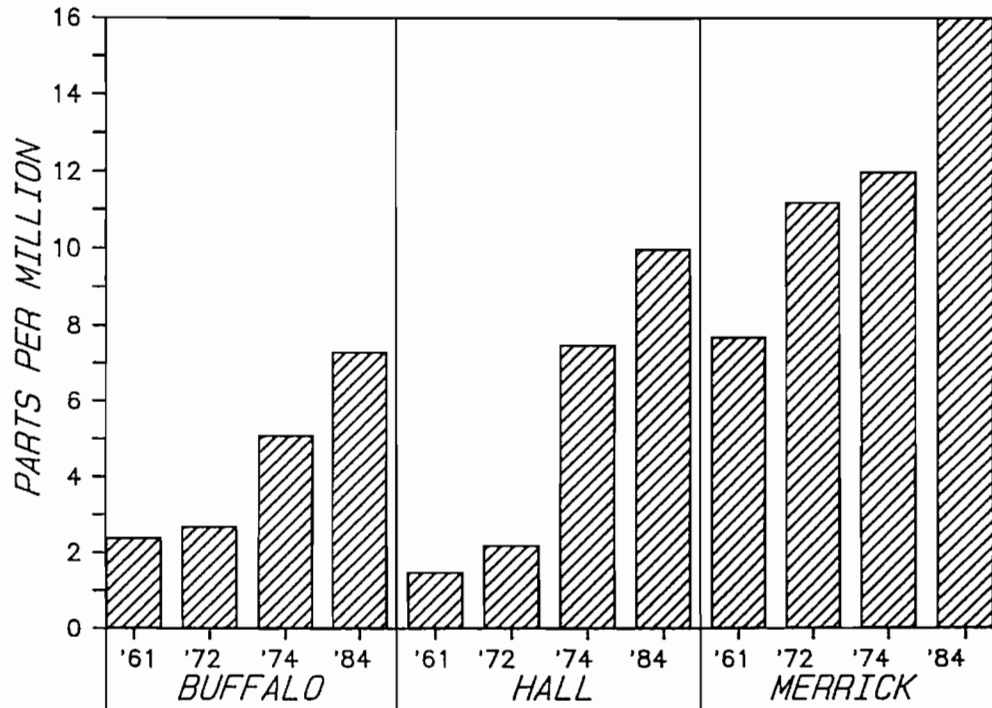


Figure 1. Changes in groundwater N03-N levels in the Central Platte Nebraska NRD.

Research and Education, and Demonstration Efforts

At present several educational programs based on research for dealing with management of agricultural chemicals are in place. Research and extension information has been available since the early 1960's stating that improved water management to reduce leaching and improved management to match nitrogen applications to the crop yield goal are important.

Twenty years ago Professor Robert Olsen was stressing the importance of deep sampling for residual nitrate to assess carryover nitrogen and using it to modify nitrogen recommendations. A substantial effort on improved irrigation management was conducted by the UNL Ag Engineering Department in the late 1970's with a grant from the Burlington-Northern Foundation. During the late 1970's the Hall County Project in the Central Platte NRD was a combined effort between the Cooperative Extension Service, SCS and the ASCS and provided cost-sharing for farmers to improve their nitrogen management by using soil sampling, split N application, improved irrigation management, and shorter irrigation runs. The history shows educational institutions to change nitrogen management that could ultimately affect groundwater quality. Most farmers and fertilizer dealers have been slow to adopt the new practices until recently. Consequently today we have legislation that guides nitrogen management practices.

Special Groundwater Protection Area

The Central Platte NRD has developed and is in the initial stages of a plan that will control nitrogen applications and will influence nitrogen management decisions in the areas that have been designated as a special groundwater nitrate protection area. The Central Platte NRD has established a network of over 500 quality monitoring wells across their district (Figure 2). Both domestic and irrigation wells are used in this survey as a basis for calculating what the average nitrate level is in the area groundwater. The area has been divided into different phases for implementation of different management strategies. These are called Phase 1, Phase 2 or Phase 3 areas.

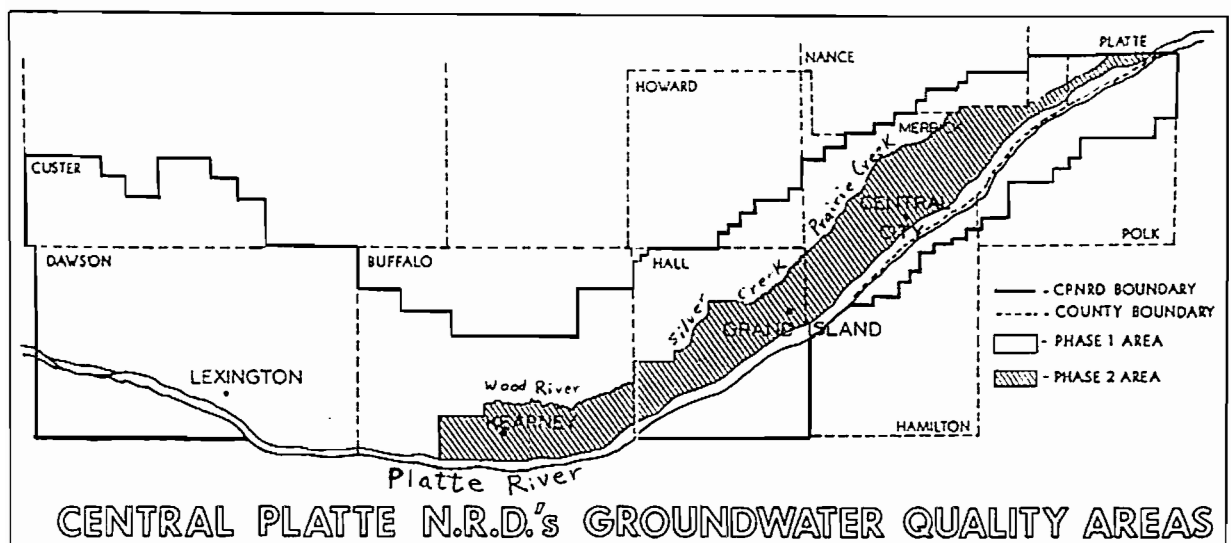


Figure 2. Phase 1 and Phase 2 areas in the Central Platte Nebraska NRD.

Phase 1 areas are those parts of the NRD where the average nitrate-nitrogen concentration of the groundwater is between zero and 12.5 ppm. The only regulation in this area is the banning of fall and winter application (prior to March 1) of commercial nitrogen fertilizer on sandy soils. A sandy soil is defined as one with a permeability of 2 inches/hour or greater for at least 30 of the upper 36 inches. In phase 1 areas the NRD will be providing information and education on improving nitrogen management. The primary thrust will be deep sampling for residual nitrate nitrogen for improved nitrogen fertilizer recommendations and improved irrigation water management.

Phase 2 areas of the study are parts of the NRD where the average nitrate nitrogen concentration of the groundwater is between 12.6 and 20 ppm nitrate nitrogen. Currently the Phase 2 area covers about 440,000 acres in the Central Platte area with 4,000 to 5,000 irrigation wells. In Phase 2 areas no fall application of nitrogen will be allowed on sandy soils. Farmers will be required to attend irrigation and fertilizer management classes to become certified in nitrogen management. This certification will be good for 4 years. In Phase 2 areas an annual water analysis for each irrigation well as well as annual deep sampling for residual nitrogen on each field will be required. Nitrogen application will be permitted on fine textured soils if applied after November 1 or when soil temperature is 50 degrees or cooler provided an approved nitrification inhibitor is used. The Central Platte NRD will require farmers in a Phase 2 area to submit a report each year with the following information:

1. The results of the water nitrate analysis of each well.
2. Results of deep soil sampling on each field of 40 acres or less.
3. The crop planned to be grown and the yield goal for commercial nitrogen fertilizer recommendations.
4. Actual commercial nitrogen applied.
5. Actual yield achieved with appropriate field and well locations indicated.

Phase 3 areas are where the average nitrate nitrogen level is greater than or equal to 20.1 ppm nitrate N. Currently there are no Phase 3 areas in the Central Platte NRD. Besides the measures that apply for Phases 1 and 2 if an area reaches the Phase 3 level fall and winter application of nitrogen fertilizer will be banned on all soils until after March 1. Spring application of commercial N fertilizers will require split application or the use of an approved nitrification inhibitor if 50% or more of the nitrogen is applied preplant.

The provisions of the Special Groundwater Protection Areas seem quite severe. They are based on nitrogen research in this part of Nebraska. The Central Platte NRD has been providing funding to the University of Nebraska to do a number of on-farm demonstrations with nitrogen and irrigation water management. A technician on the project samples the fields for residual nitrate nitrogen, then works with the farmer on developing a realistic yield goal and a nitrogen rate recommendation. A nitrogen rate recommendation 50 lb below the recommended rate, the recommended rate, and a rate 50 lb above the

recommended rate are used in replicated strips through the field. Strips may be six to 12 rows wide, a quarter to a half mile long through the field. At the end of the growing season the strips are combined and weighed with a weight wagon and yields are calculated. Numerous demonstration plots in 1985, 1986, and 1987 have shown that the recommended nitrogen rates generally produce maximum yields. In many cases the nitrogen rate 50 lb less than the optimum is producing between 90 and 100% of maximum yields. In many cases there is enough residual nitrogen in the soil and nitrate nitrogen in the irrigation water that there is no fertilizer nitrogen response.

Many farmers and fertilizer dealers have a hard time believing that they can grow a crop with low nitrogen inputs. The demonstration plots seem to be necessary even in this age of technology to convince farmers that the research we have been doing for the last 20 years on modifying nitrogen recommendations based on residual nitrate tests really works on their farm. Many more farmers are using this technology today, because of two reasons. The first is the current economic situation that a more refined nitrogen recommendation means more dollars in their pocket and the second is the possible threat of the establishment of control areas in their local county or NRD.

The program in the Central Platte NRD is provided only as an example and legislation of this kind may not occur in other areas, however, the US EPA is looking at the programs in Nebraska, specifically the special groundwater nitrate protection areas and the chemigation law to be implemented in a National Strategy for states to follow if they do not have regulations. Federal legislation is coming. The only question is when.

National Groundwater Legislation Summary

Currently there are at least 10 groundwater bills that have been introduced into the 100th Congress since it convened in January, 1987. Politically groundwater is a hot potato. In May 1987 EPA Administrator Lee Thomas acknowledged that he had changed his mind regarding the need for Federal groundwater protection legislation. He believes federal legislation is needed because a disjointed approach may lead to heavier federal involvement than is appropriate. He also concedes that federal legislation is necessary to clarify the respective roles of state and federal governments to achieve consistency and coordination among federal agencies.

Support is building for comprehensive federal groundwater legislation. The Environmental and Study Institute, a bicameral and bipartisan congressional organization, held a major conference on groundwater in May with committees of both the House and the Senate. There appears to be disagreement over the federal role and strategies for setting the standards. Resolving these differences may be difficult and lengthy.

Research and Protection Strategies

There are two major components of the current bills - groundwater protection and support for research. Bills that have been introduced are either designated S for Senate or HR for House of Representatives. There have been four research bills introduced to deal with USGS, (United States Geological Survey) responsibility (HR791 and S513) and one deals with EPA responsibilities (HR2253). The fourth bill (S1105) is a federal research coordination in general. A recent bill (HR3069) is called the Agriculture Nitrogen Best Management Practice bill. It is being merged with HR791.

The other major groundwater issue is that of protection strategies. To date S20 and House companion bill HR963 are the only bills that propose that management plans and protection programs be required of the states under EPA's leadership. Some miscellaneous bills also exist. S1419 and HR2463 single out pesticide contamination as an issue and provide for both research and protection strategies. HR2320 employs what might be called a carrot and stick approach to encourage the reclamation states in particular to better protect and manage their groundwater resources.

Because no one agency deals totally with groundwater numerous federal agencies and congressional committees are becoming involved in the issue. On the Senate side the Environment and Public Works Committee has taken a lead, however, Energy and Natural Resources and Agriculture and Nutrition and Forestry also want to be involved in legislation that is proposed. On the House side there is also a question of jurisdiction. A recent Congressional Research Service found that as many as 11 House Committees and 13 Federal Agencies can claim some jurisdiction over groundwater. Congressman George Brown of California has proposed that a "Groundwater Task Force" be established to coordinate and monitor groundwater work by the various House of Representatives Committee.

In summary there appears to be significant congressional interest in developing conference of groundwater legislation. The House may pass some legislation this session but the Senate may not work on their bills till 1988.

Summary

Water quality will continue to be a National and Nebraska issue. As industry and extension people we may be called on to provide the best information that can be used in making decisions related to groundwater quality because we make recommendations for chemicals that find their way to groundwater. The American consuming public has benefited greatly from the use of chemicals in agriculture that have kept the price of food down. In a society where almost everyone is totally removed from the food production process they do not realize the importance of agricultural chemicals and that in many instances the risks of many of these chemicals and other carcinogens are much lower than suspected (Ames, et al., 1987). We must educate a public to the importance of the wise use of agricultural chemicals and avoid what I feel is a developing

chemophobia. Certain influential people could totally ban the use of chemicals in agriculture. There have been misuses in the past where higher than needed rates of agricultural chemicals and nitrogen have been applied. We also need to guard against this problem. In balance, we need to support the use of agricultural chemicals but support a wise use that can provide economic crop production while reducing the impact of chemicals on the groundwater.

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