

# Drinking Water Source Protection and GIS in Reno County, Kansas

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## Abstract

Reno County has a population of approximately 60,000 people, 40,000 of whom live in the city of Hutchinson. Hutchinson's water system is dependent entirely upon groundwater for its drinking water supply. The Equus Beds Aquifer, from which groundwater is withdrawn, is a shallow alluvial aquifer formed by the Arkansas River and is overlain by sandy soils. As a result, local groundwater is vulnerable to contamination. Three of Hutchinson's twenty public water supply wells are not currently used due to the presence of volatile organic compounds. In response to this threat, county and city governments formed a wellhead protection committee to develop a drinking water protection plan. The goal of this plan is to limit, as much as possible, future threats to groundwater. The US Environmental Protection Agency describes wellhead protection planning as a five-step process. These steps are: form a planning team; delineate the protection area; inventory the potential risks of contamination within this area; manage the protection area; and plan for the future. Geographic information system (GIS) software was used during the initial consensus-building phase of this project to produce maps for use at public information and planning meetings. GIS mapping was also used to store and display the results of the potential contamination source survey as well as the wellhead protection zone. This protection zone was derived from a computer simulation of three- and five-year zones of groundwater capture for each public water supply well.

Keywords: wellhead protection, non-point source pollution, groundwater, drinking water, source water protection

## Program History

The Reno County (Kansas) Health Department, working in cooperation with the city of Hutchinson, Kansas, established a wellhead protection (WHP) steering committee in 1996. The Health Department has funded the WHP program with Local Environmental Protection grants from the Kansas Water Office, along with in-kind services from a variety of local agencies. The steering committee has formed an advisory board whose function is to provide public input into each stage of the plan's development. Volunteers from the Retired Senior Volunteer Program (RSVP) and the community college were trained and used to conduct door-to-door inventories that were then used in this project to evaluate the severity of the potential risks to Hutchinson's water supply.

The first task facing the WHP steering committee was to determine the source of

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the public water supply. The second task was then to describe the risks to water quality within that area. With the exception of chlorination, groundwater is not treated prior to its use as drinking water. Program goals are:

- Identify the surface area having the greatest impact on drinking water quality.
- Identify the threats to groundwater quality within that area.
- Develop and implement a strategy of education and pollution prevention to reduce the impact of current activities on groundwater.
- Encourage groundwater-friendly growth and development in the WHP zone.

### **Problem**

Hutchinson is dependent entirely upon groundwater for its source of drinking water. Three of the 20 municipal wells are not currently used due to the presence of volatile organic compounds. A fourth is not used because a high mineral content gives it an unpleasant taste (Figure 1). The city has invested many of its resources into the development of a series of wells outside the city limits. Currently the water quality in these wells is good. If quality concerns arise in this second wellfield, the alternative would be the construction of a costly water treatment plant and the restructuring of the water distribution system.

### **Data Development and Analysis**

The decision of what information to use, and how it was then tied together spatially, was based on the need to spend as little time creating new data files as possible. Some of the information was already complete before the project began but resided on different systems and file structures. Two of the datasets specifically created for this project were "zones of capture," which identifies the WHP zone, and "potential pollutant inventory," a database created from information gathered in the door-to-door survey. Respondents were asked for information on equipment and practices associated with the potentials for groundwater contamination. Table 1 displays the data gathered in that survey.

Once the data were collected and developed, maps were generated that spatially displayed the distribution of each inventoried pollutant through the WHP zone. Fertilizer and pesticide usage were tracked according to their number of applications per year. No attempt was made to determine if these chemicals were overapplied. Querying the inventory database and selecting the associated parcels produced maps showing the distribution of each potential pollutant. Approximately 85% of the 800 parcels in the surveyed area responded to the potential contaminant risk survey. Information on the remaining parcels was not obtained due either to property owner resistance or inability to contact the owner.

### **Implementation**

The results of our efforts so far have shown that the major threats to the northwest wellfield now and for the near future are agricultural and suburban lawn and garden fertilizer usage, and the dependence of homeowners on private septic systems. Best

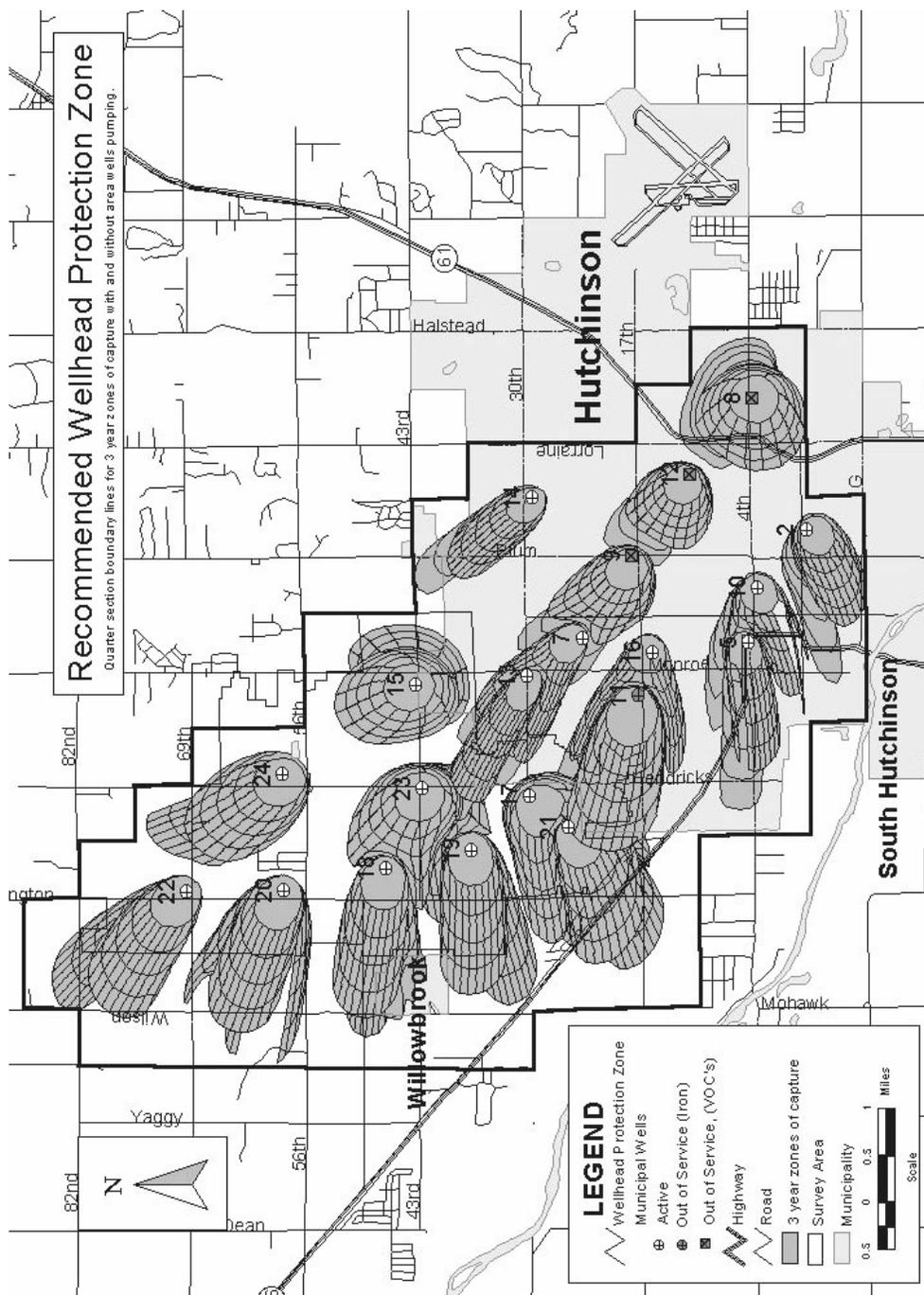


Figure 1 Recommended wellhead protection zone and survey area.

**Table 1** Incidence Rates of Potential Sources of Groundwater Contamination, Northwest Wellfield Survey Area, Reno County, KS, 1996

Potential Source of Groundwater Contamination	City Parcels <sup>a</sup> with Potential Contamination Source	Potential Contamination Sources in City Parcels <sup>a</sup>	County Parcels <sup>a</sup> with Potential Contamination Source	Potential Contamination Sources in County Parcels <sup>a</sup>	Total Parcels <sup>a</sup> with Potential Contamination Source	Total Potential Contamination Sources in Parcels <sup>a</sup>	Comments
Fertilizer use	254	1.8 <sup>b</sup>	32	1.1 <sup>b</sup>	286	1.7 <sup>b,c</sup>	Applied to 1,715 acres
Domestic water well	110	117	87	106	197	223	
Other water well	189	191	28	30	217	221	
Pesticide use	130	1.2 <sup>b</sup>	9	1 <sup>b</sup>	139	1.2 <sup>b,c</sup>	Applied to 439 acres
Septic system	12	13	79	86	91	99	
Other	35	N/A	24	N/A	59	60	Primarily pipelines
Above-ground tank	1	4	16	24	17	28	
Abandoned water well	5	7	12	17	17	24	
Stream	1	1	17	17	18	18	
Chemical storage	9	10	0	0	9	10	
Grain storage bin	0	0	4	9	4	9	
Chemical storage facility	2	2	1	1	3	3	
Underground storage tank	1	1	2	2	3	3	
Septage disposal	0	0	2	2	2	2	
Animal feedlot	0	0	2	2	2	2	
Salvage yard	0	0	1	1	1	1	
Private dump	0	0	1	1	1	1	
Airstrip	0	0	1	1	1	1	
Cemetery	0	0	1	1	1	1	
Injection well	0	0	0	0	0	0	
Oil/gas well	0	0	0	0	0	0	
Quarry/sand pit	0	0	0	0	0	0	
Pit privy	0	0	0	0	0	0	
Lagoon	0	0	0	0	0	0	
Chemigation	0	0	0	0	0	0	

<sup>a</sup>Parcels within survey area<sup>b</sup>Number of applications per year<sup>c</sup>Weighted average

N/A = Not applicable

management practices (BMPs) for both of these issues have been developed by the steering committee and have been partially implemented by the Health Department and Conservation District. The focus now is to increase the number of landowners implementing these BMPs. This can be accomplished by increasing local funding of voluntary cost share programs, which reimburse property owners for a portion of the costs of implementing BMPs; raising awareness of the problem through education; and amending local codes to raise mandatory minimum standards of construction and operation, to reduce bacterial and nitrate contamination from septic systems.

Education of the public regarding groundwater quantity and quality issues was recognized early on as a key element to the program's success. Toward that goal, a partnership with the Hutchinson School District to provide groundwater education at the elementary and middle school levels began with the 1997–1998 school year. This program is not just for Hutchinson but is serving as a model for the 13 other towns and rural water districts of Reno County. What began as a program to protect Hutchinson's water supply has evolved into a true public health bargain that allows public water suppliers to meet upcoming US Environmental Protection Agency deadlines to meet Safe Drinking Water Act regulations on source water protection.

### **Acknowledgments**

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