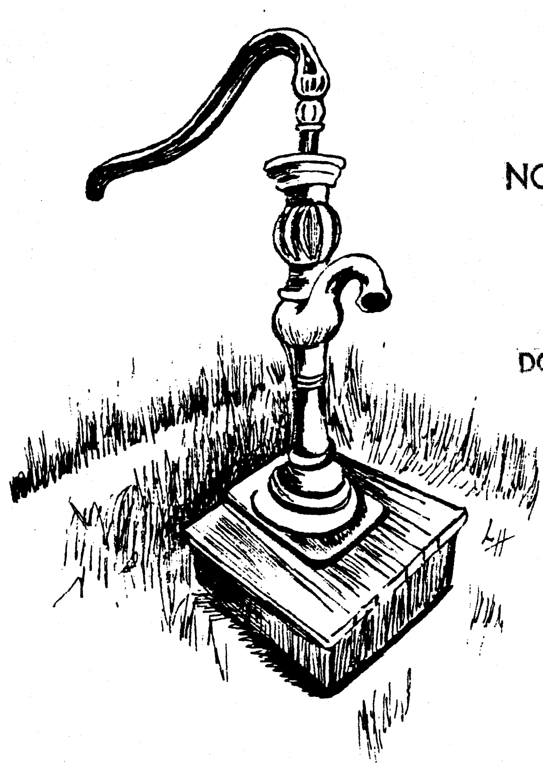
Rhode Island Department of Environmental Management
Division of Groundwater and Freshwater Wetlands
Groundwater Section

RHODE ISLAND PRIVATE WELL SURVEY

FINAL REPORT

May 1990



EXECUTIVE SUMMARY

In response to a growing concern with groundwater contamination in Rhode Island, the Rhode Island Department of Environmental Management (RIDEM) initiated in 1986 a survey of the water quality of private wells, known as the Private Well Survey. Funded by a special legislative appropriation, the RIDEM contracted for the selection, sampling, and analysis of 463 wells statewide. The survey was intended to screen for contamination in private wells located in different land use settings. The land uses included in the survey all posed a potential pollution threat to groundwater. Categories included industrial areas, dense residential (unsewered) areas, junkyards and various agricultural activities. As a background reference, private wells in areas considered free of contamination were also sampled.

A total of 458 private well owners residing in 32 areas participated in the study. Several owners had two wells on the same property and both were sampled. The total number of wells sampled was 463. Duplicate samples were collected from 22 wells. Therefore, the total number of samples taken for analysis was 485. The parameters analyzed for in each well/site varied with the land use category.

The overall results for the Private Well Survey indicate that the groundwater quality in Rhode Island is very good. The major findings of the Private Well Survey are presented below.

Radon

Radon, a naturally occurring gas, was detected in every private well tested. The majority of the radon results, i.e. 88%, are below 10,000 picocuries per liter (pCi/l). These results are characteristic of New England, which is underlain by granitic rocks. The United States Environmental Protection Agency (USEPA) is presently considering a primary drinking water standard for radon in groundwater in the range of 200 to 2,000 pCi/l. This range would place 98% of the samples over 200 pCi/l and 65% of the samples over 2,000 pCi/l.

Nitrate

Nitrate is a naturally occurring compound in groundwater which can be influenced by human activities. Although nitrate was detected in 81% of the samples, only 1% of the samples were above the primary drinking water standard of 10 milligrams per liter (mg/l). Elevated concentrations of nitrate (greater than 5 mg/l) were detected in 12% of the total samples. The highest nitrate concentrations were found in the individual sewage disposal system (ISDS) and agricultural land use categories.

Iron and Manganese

Iron and manganese are naturally occurring, and two of the most common elements of the earth's crust. These parameters were detected in approximately two-thirds of all samples, and secondary drinking water standards were exceeded for iron in 24% of the samples and for manganese in 37% of the samples. These elevated concentrations of iron and manganese are typical of the New England terrain and do not represent a health threat.

Lead

Lead was detected in a quarter of the total samples analyzed, but 80% of the lead detections were below 0.01 mg/l. Only three samples (0.6% of the total samples) had concentrations above the primary drinking water standard of 0.05 mg/l. Lead occurs naturally in groundwater at trace levels. However, lead in samples from households is often due to leaching from lead pipes and lead-based solder joints. In one of the cases, a follow-up analysis revealed that the tap water was not allowed to run before sampling, therefore collecting lead from the piping and resulting in higher lead concentrations.

Sodium

Sodium was detected in all private wells tested. Sodium occurs naturally in groundwater, but runoff from highways and salt storage areas may lead to elevated concentrations of sodium in groundwater. Sodium concentrations exceeded the Rhode Island Department of Health (RIDOH) action level of 100 mg/l in ten wells, or two percent (2%) of all samples tested. Proximity to a salt storage pile may have contributed to higher concentrations of sodium in one well. The remaining nine wells are located in the vicinity of major highways, where road salting is a likely contributing factor.

Volatile Organic Compounds (VOCs)

VOCs, also known as purgeable organics, are synthetic compounds, and their presence in groundwater is the result of human activities. The presence of VOCs in groundwater is one of the leading causes for well closures statewide. The compounds found with greatest frequency include common solvents and degreasers such as: trichloroethene (TCE), 1,1,1-trichloroethane and tetrachloroethene (PCE). Of all the private wells tested, 27% (126 wells) contained VOCs. The majority of the detections (81%), however, were below five parts per billion (5 ppb). Primary drinking water standards were initially exceeded in 19 wells (four percent of wells tested), but in all cases in which follow-up testing was authorized (15 wells), VOC concentration levels were not detectable in 13 wells, except for two occurrences of Freon 12 present at safe concentration levels.

Pesticides

No widespread pesticide contamination was detected as a result of this study. Pesticide concentrations in groundwater did not exceed proposed drinking water standards or health advisories. This survey did not include areas of the state that were already affected by the pesticide aldicarb. A broad range of pesticides was tested for, and seven types of pesticides: aldicarb, atrazine, butylate, carbaryl, carbofuran, dicamba and dinoseb, were detected in 28 of the 256 wells investigated (11% of the total). The concentrations at which these pesticides were detected were extremely low - about two to three orders of magnitude lower than their corresponding drinking water standards.

CONCLUSIONS

In summary, of the 463 wells tested initially, six percent (6%) were reported to have levels of contaminants which exceeded primary drinking water standards (health related). Follow-up testing by RIDEM at many of these wells failed to confirm a persistent contaminated condition. Consequently, when all sampling results are considered, 98% of the wells were found to meet acceptable standards. In evaluating correlations between land use and water quality of nearby private wells, a correlation for nitrate was identified. In this study, local geology was determined to have the greatest influence on the quality of groundwater.

The only parameters for which primary drinking water standards were exceeded were nitrate, lead, and some volatile organic compounds (VOCs). Follow-up samples of wells initially reporting elevated concentration levels of VOCs, typically resulted in non-detectable concentrations. Two occurrences of Freon 12, present at safe concentration levels, were the exception. Pesticides were detected rarely and at very low concentrations, and did not present a health concern. Iron and manganese, which are naturally occurring, were frequently found to exceed secondary drinking water standards (aesthetic concern). Radon, also naturally occurring, exceeds several proposed primary drinking water standards in most samples. This is expected to become an important issue in the future.

I. INTRODUCTION

A. Overview

Groundwater is one of Rhode Island's most valuable natural resources. According to estimates of the United States Geological Survey (USGS), over 24% (235,710 persons) of the state's population relies upon groundwater for its drinking water needs (Solley and others, 1988). A significant segment of the total population, 8.7%, is served by an estimated 31,000 private wells (Johnston and Baer, in press). Although a small portion of the overall water supply, private wells are vital to certain suburban and rural regions of the state. Households in such areas are entirely dependent upon groundwater and lack viable alternative water supply options should contamination occur.

In 1986, the Rhode Island Department of Environmental Management (RIDEM) initiated a statewide survey of private wells in order to evaluate the extent of groundwater contamination problems. The survey was intended to screen for contamination in private wells located in different land use settings. The land uses included in the survey all posed a potential pollution threat to groundwater. Categories included industrial areas, dense residential (unsewered) areas, junkyards and various agricultural activities. As a background reference, private wells in areas considered free of contamination were also sampled.

The information gathered from this survey was intended to support the further refinement and implementation of Rhode Island's groundwater protection programs. Unlike public water systems, the water quality of private well supplies is largely unregulated by state authorities. The responsibility for monitoring well water quality generally rests with the homeowner. However, the RIDEM regulates many of the pollution sources which have caused or may cause groundwater contamination. In recent years, a growing number of complaints concerning well contamination has resulted in an expansion of the state's role, which is reflected in RIDEM's groundwater investigative work and the Rhode Island Department of Health's (RIDOH) private well monitoring activities.

The Private Well Survey was designed to provide the state with additional data to evaluate the overall extent and quantity of contamination in private wells. Some of the questions that the RIDEM set out to answer were:

(1) Have different land uses adversely affected the water quality of nearby private wells?;
(2) Have drinking water standards been exceeded in the affected wells? If so, what response action was required to resolve the problem?

(3) Are there private wells presently threatened by certain land use activities? If so, what steps can be taken to prevent groundwater contamination that exceeds drinking water standards?

It was hoped that the survey results would contribute to a better understanding of the impacts of land uses on groundwater quality and assist in the continuing development and implementation of groundwater protection and remedial action programs.

B. Historical Background

Prior to the undertaking of the Private Well Survey, Rhode Island experienced several notable incidents of groundwater contamination stemming from industrial and agricultural land use activities. The cases in point are briefly discussed below. They are similar in that the state expended considerable effort and resources in responding to the contamination problems:

- In 1969, a spill of trichloroethene (TCE), a commonly used solvent at the Stamina Mills Site in North Smithfield, resulted in the contamination of a neighborhood association well and nearby private wells (GHR Engineering Associates, Inc., 1989). A public water line funded by the state and the town was installed to service the affected area in 1980. Final cleanup of the site is being pursued via the federal CERCLA (Superfund) program. The site is one of 11 sites in Rhode Island on the National Priorities List.

- During 1978 to 1981, various overflows, leaks and releases of organic chemicals at the North Central Industrial Air Park resulted in the contamination of private wells (RIDEM, 1982). An Emergency Well Testing Program indicated the presence of organic chemicals in 74 private wells in the area. Nine wells were contaminated at concentration levels above drinking water standards. After 24 months of investigation, the RIDEM identified several plumes and potential pollution sources. The extent of the problem prompted the Town of Lincoln to install public water lines to homes throughout the affected area.

- In 1979, residents of the Canob Park neighborhood in Richmond reported gasoline contamination in their wells. An investigation by the State and the USEPA identified two gasoline stations as the sources of the problem. To resolve the water supply contamination, a new community well system was installed in 1984, years after the initial discovery of the problem.

- In the mid-1980s, complaints concerning use of the pesticide aldicarb, manufactured under the trade name Temik, prompted a widespread private well sampling program in southern and

southeastern portions of the state. Used on potato fields, the registration of aldicarb was discontinued in Rhode Island as of December 1985 (Division of Agriculture, RIDEM) after the pesticide was detected in a large number of wells. Between 1984 to 1988, of the 1,141 wells sampled by RIDOH, 62 wells had concentrations above the health advisory level (Combs, 1988; Barrette, 1988). An additional 154 wells exhibited concentrations below the advisory level. Union Carbide, the manufacturer at the time, and more recently Rhone-Poulenc, provided carbon filters to homes with levels considered undrinkable; the state funded the provision of filters to all others in which aldicarb was detected. Re-bedding of the filters was also provided by the State on a one time basis.

While a complete count of contaminated wells in Rhode Island has never been undertaken, the RIDEM has estimated that at least 300 private wells have required treatment or had to be discontinued from use due to contamination problems. The experiences described above, along with a growing concern about groundwater contamination and an interest in obtaining more data on private wells, all contributed to the impetus for the Private Well Survey.