Factsheet on the Groundwater Pathogen Monitoring at Community Water Systems, September 2009

Background: The United States Environmental Protection Agency published the Ground Water Rule (GWR) in the Federal Register on November 8, 2006. The purpose of the GWR is to provide for increased protection against microbial pathogens, particularly fecal contamination, in public water systems that use groundwater sources.[1] By December 1, 2009, community water systems (CWSs) throughout the country must comply with this new regulation.

Illinois drinking water law and regulations are more stringent than the GWR, because in addition to treatment, using the best available source is required.

While the Illinois Pollution Control Board promulgated the GWR on July 26, 2007,[2] Illinois drinking water law and regulations have dealt with the threats posed by bacteria and pathogens for quite some time. In fact, state law and regulations are more stringent than the GWR in that they address not only monitoring pertaining to sanitary quality,[3] but also the use of the best available source,[4] as well as treatment of groundwater with unfavorable characteristics.[5]

Nonetheless, the Illinois Environmental Protection Agency (Illinois EPA) has taken a fresh look at evaluating the sanitary quality of the groundwater used by CWSs in Illinois.[6] Beginning in September of 2007, Illinois EPA initiated a more thorough procedure for collecting bacteria samples from CWS wells. While many Illinois water supplies already collected well samples for total coliform prior to this date, Illinois EPA began requiring sampling at all wells on a monthly basis for total coliform and Escherichia coli (*E. coli*) bacteria. This source sampling was done concurrently with the Total Coliform Rule (TCR) sampling conducted at sites in the distribution system.

The benefit of this monitoring is two fold. **First and foremost, this data have identified wells at risk which, in most cases, has led to mitigation efforts.** Secondarily, this approach has allowed us to compare source water monitoring to TCR distribution system monitoring to evaluate the efficacy of a triggered monitoring approach. The GWR provides for triggered

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[1] Disease-causing pathogens may be found in fecal contamination. These pathogens are generally more difficult to treat than bacteria normally tested for and found in water.
[2] See 35 Ill. Adm. Code 611, Subpart S
[3] See 415 ILCS 5/19
[4] See 35 Ill. Adm. Code 611.231(c)
[5] See 35 Ill. Adm. Code 611, Subpart B
[6] Illinois EPA submitted a strategy for implementation of the GWR to the U.S. EPA Region 5 on June 28, 2007, and received concurrence on August 20, 2007.

monitoring of representative source (wells) based on 1 TCR positive in the distribution system. The Illinois EPA has determined that triggered monitoring based on TCR positives is not a good predictor of potential pathogen contamination in the source water. In fact, 76 percent of the well detections would have been missed by triggering monitoring initiated by 1 or more TCR distribution system positives. Moreover, 81 percent of the distribution system positive TCR detections led wells with no source water detections. This would not be an effective use of water supply resources to track down these dead-ends.

Additionally, as part of this effort, Illinois EPA has initiated the process of educating water supply officials and operators. Systems have been provided preliminary information about the GWR and state regulations via letters, seminars, and meetings. As resources allow, the Illinois EPA plans to continue this process through the 2009 effective date of the GWR.

95% of Illinois CWS wells appear to be using a safe source of groundwater.

Results: To date, 3,828 wells have been (and continue to be) tested and evaluated at CWS's across the state. Based upon available data, 3,604(or 94 percent) of these wells are currently viewed as using a sanitarily safe source of groundwater. Of the 224 (or 6 percent) CWS wells that have shown bacteria contamination 17 wells are in the process of being evaluated for necessary corrective actions. The remaining 207 wells have actually addressed (or are addressing) sanitary defects or corrected monitoring location concerns.

Table I, maps 1 and 2, and the associated graphs below describe and illustrate the corrective actions undertaken to address bacterial detections in the samples collected.

Table I. Remedy/Action/Investigation	**Number**
Installed new sample taps	62
Installed appropriate long term treatment	4
Quit using the well source	24
Drilled a new well	3
Detections as a result of well rehabilitation	17
Wells were shock chlorinated	17
Targeted treatment for speciated bacteria	5
Deficiency (e.g., holes in the casing)	32
Investigation is on-going	16
Determined to be groundwater under the direct influence of surface water	3
Received Violation Notice and submitted CCA (Compliance Commitment Agreement)	24
Total	**207**

To further focus outreach and technical assistance efforts, the Illinois EPA has initiated evaluation of potential correlations between bacteria occurrence, hydrogeology, and other factors. As a first step, occurrence data was referenced to wells using geologically confined[7] or unconfined aquifers. Of the 3,604 wells that are currently viewed as having sanitarily safe source water, 2,352 (or 65 percent) utilize geologically confined wells. In contrast, 136 (or 61 percent) of the 224 wells that were initially viewed as having bacterially contaminated water use confined aquifer systems. However, 125 of 136 CWS wells using confined aquifers, with consistent bacterial sample detections, have been addressed. Bacterial sample detections for 42 of these 125 wells were determined to be related to using improper sample taps, and 16 of the 125 wells were determined to have integrity issues (e.g., holes in the casing).

66 percent of the wells not showing bacteria detections utilize confined aquifers.

The remaining 11 CWS wells utilizing confined aquifers (5 percent of the initial 224 wells with detections) continue to be evaluated to determine if the problem is related to hydrology or other issues. The age of these 224 CWS wells was also analyzed and is displayed in the second map and associated graphs below. There is a strong correlation between the increasing age of the well and detections in sample results for CWS wells using a confined aquifer. With this said, the data analyzed to this point appears to show that certain geologic conditions can provide an effective hydrologic barrier (assuming proper engineering controls) to protect groundwater sources of drinking water from pathogenic contaminants.

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Additionally, evaluation shows a high percentage of CWS wells with bacterial contamination to be in proximity of a river or stream. If the detections determined to be related to improper sample taps (64) and well deficiencies (32) are subtracted, it results in a total of 130 wells with bacteria detections. Sixty one (61) of these 130 wells (46 percent) were located within 1,000 feet of a stream or river[8], as shown in map 3. These 61 CWS wells using an unconfined aquifer can be further characterized, as described in Table II:

[7] "Confined aquifer" means an aquifer bounded above and below by impermeable beds or by shale, clay, or siltstone. (35 Ill. Adm. Code 671.102)

[8] The National Hydrology Data set was used to conduct this analysis.

Table II. Distribution of CWS wells using unconfined aquifers with bacterial detections in proximity to streams or rivers			
Stream buffer distance	**0 – 199 feet**	**200 – 499 feet**	**499 – 1,000 feet**
Number of wells	20 wells	21 wells	20 wells

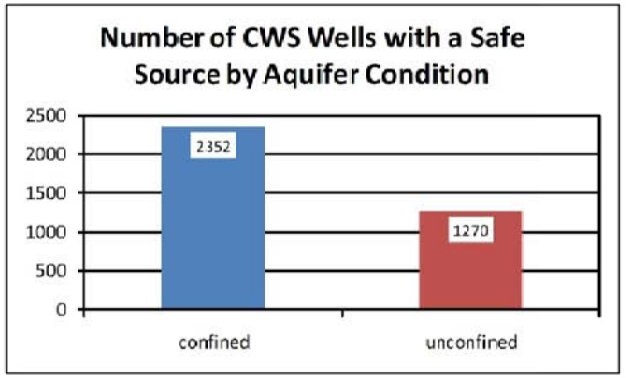
Three (3) of these wells have been determined to be groundwater under the direct influence of surface water.

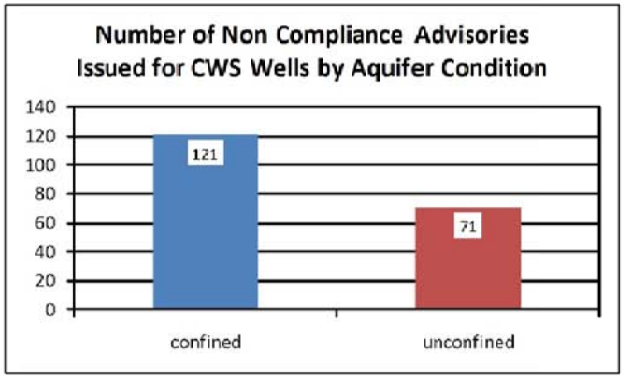
In 2008, Illinois EPA has compared 147 CWS wells[9] representing 105 CWSs (systems) with bacterial contaminant detections versus the CWS (systems) (131) with 1 or more TCR, distribution system positive detections[10]. This comparison yields that the distribution samples with one or more TCR positives did not predict 76 percent of the CWS (systems) with consistent bacterial contamination occurring in the source water. One theory is that treatment may be masking viral pathogens. In any case, these statistics affirms the need for a multi-barrier approach to providing safe drinking water. Furthermore, instead of focusing on real issues, 81% of the TCR positive detections lead to systems with no source water detections.

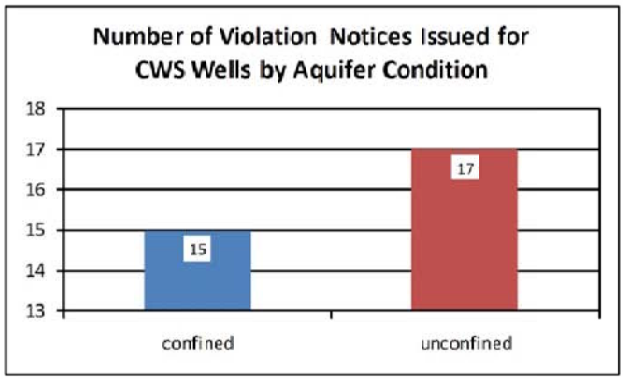
Therefore, triggered monitoring based on TCR positives would have missed a significant number of potential source water issues (76 percent), and 81 percent of the TCR monitoring detects would have misdirected water system resources to sources that are not susceptible to microbial pathogens.

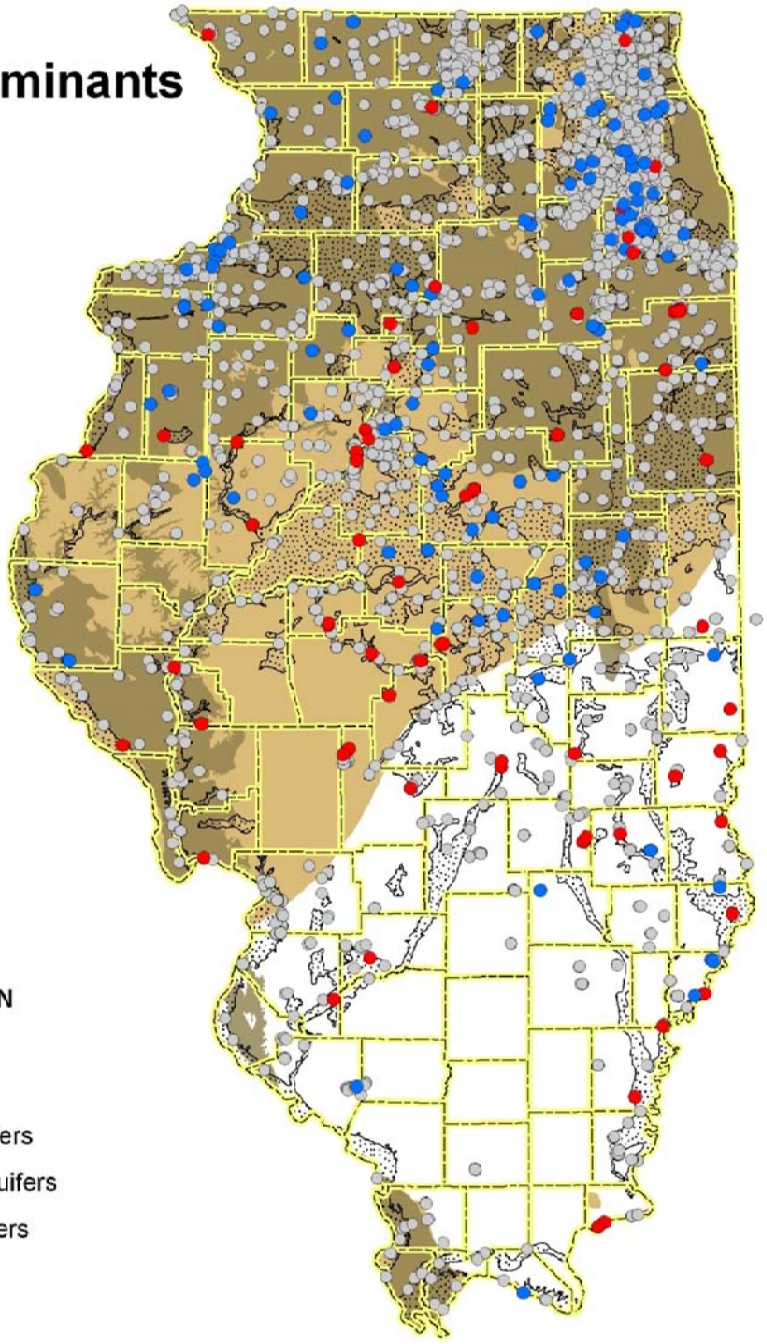
[9] (179 wells - 32 detects attributed to improper sample taps = 147 wells)
[10] TCR compliance monitoring data collected during 2008

CWS Wells Assessed for Pathogenic Contaminants









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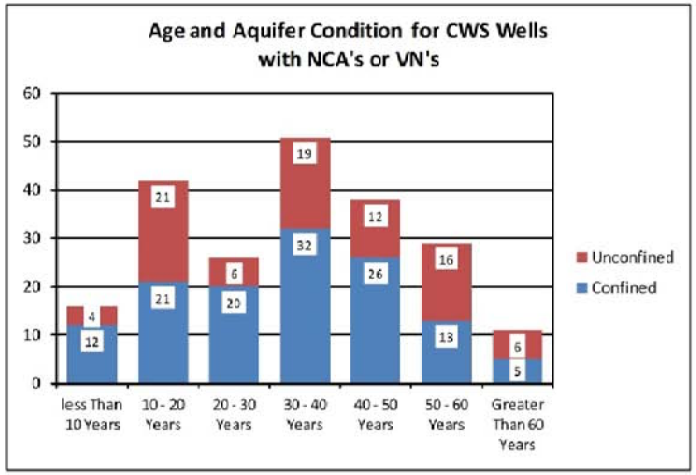

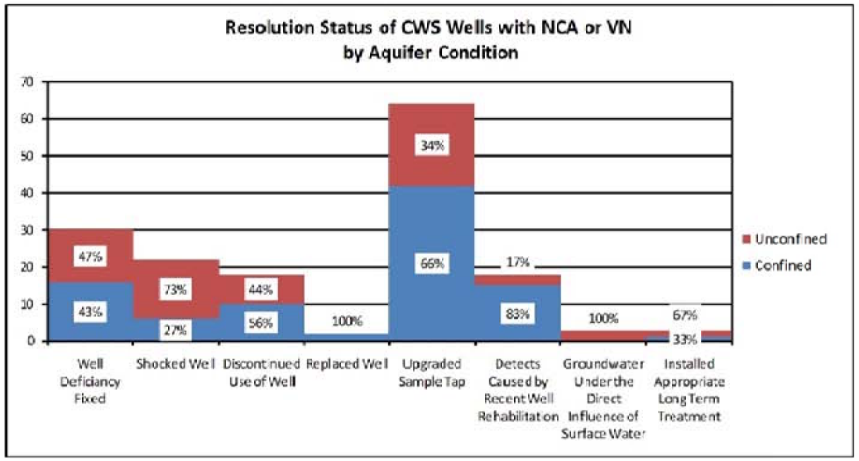

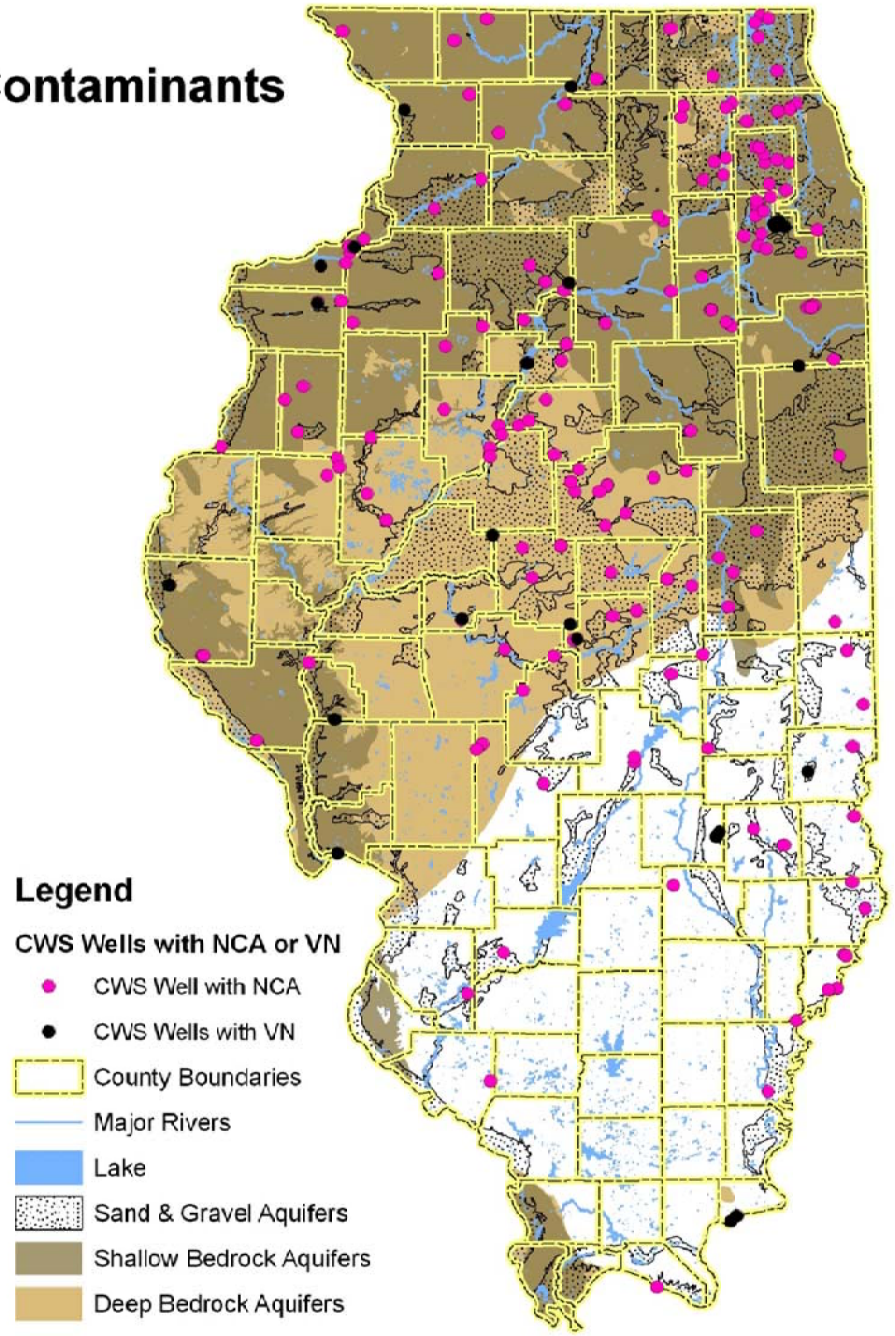

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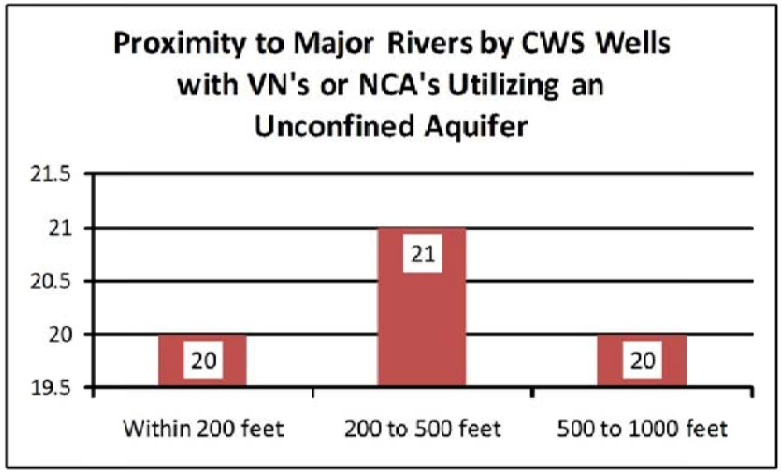

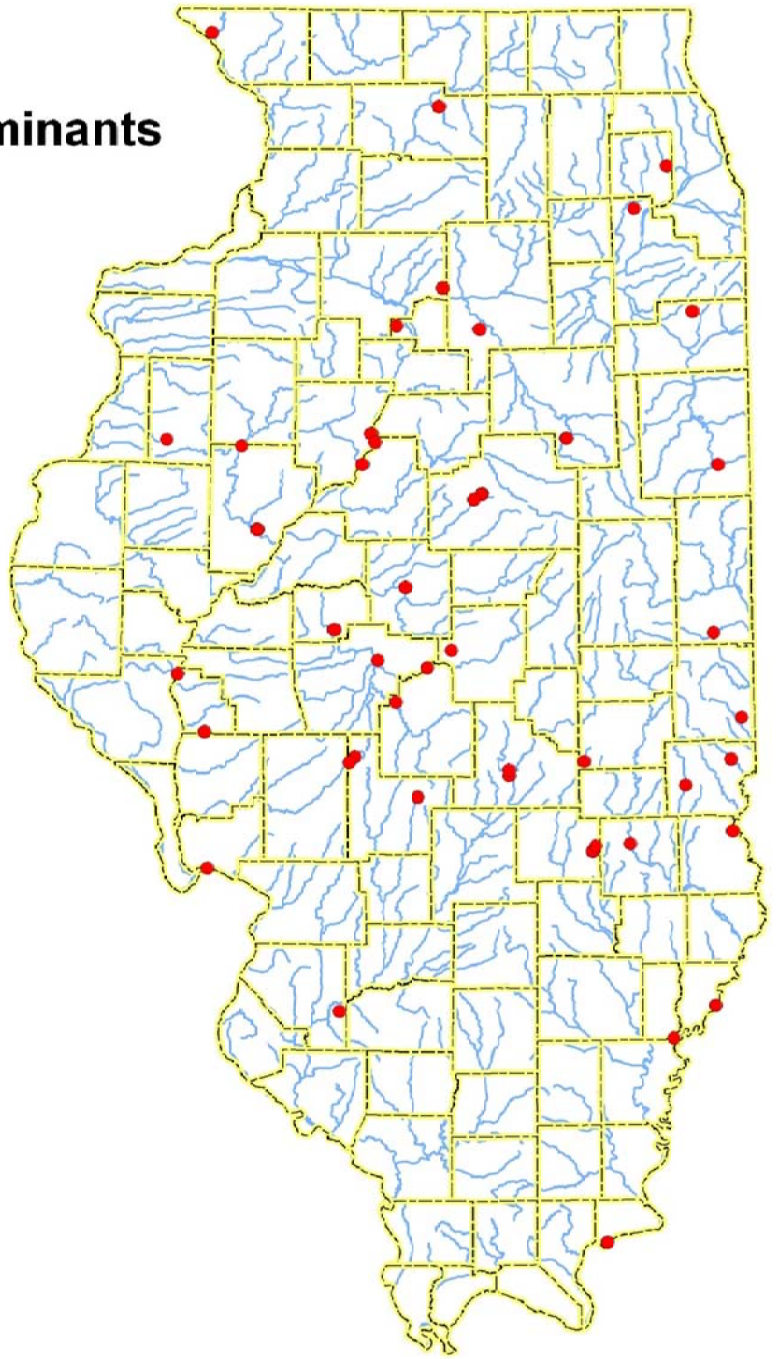

Legend

- Unconfined CWS Wells within 1000 Feet of a Major River with NCA or VN
- County Boundaries
- Streams