# Vermillion and Vermillion Township Private Well Sampling

The purpose of community focused sampling is to provide all county residents using a private well for drinking water a chance to test their well water for common contaminants. This report contains a summary of the results from private wells. Water samples were tested for the presence of geologically derived contaminants manganese and arsenic, as well as human-related contaminants lead, chloride, and nitrate.

## Study Approach

Results from rounds of sampling in 2020 and 2021 are summarized in this report. The County received 94 test kits. Residents were asked to collect a water sample from both an outside untreated spigot and an inside primary drinking water tap. All outside samples were tested for manganese, arsenic, nitrate, and chloride. If the outside sample result exceeded 3.0 mg/L for nitrate, 0.05 µg/L for arsenic, or 0.090 mg/L for manganese, then the sample collected from the inside tap was tested for that chemical. In addition, all inside tap samples were analyzed for lead. A hardness test strip was provided as part of the sampling kit for well owners to test and report when submitting samples. In addition, the participants completed a survey indicating all water treatment methods affecting the inside tap.

| Chemical | # of Well Samples | # of Detects | Drinking Water Guideline (DWG) | # of Samples above DWG | Mean (Average) Result | Maximum Result |
|---|---|---|---|---|---|---|
| Outside Arsenic µg/L | 94 | 15 | 10 µg/L<br>No safe amount | 0 | 0.21 | 3.88 |
| Outside Chloride mg/L | 94 | 66 | 250 mg/L* | 0 | 12.4 | 107 |
| Outside Manganese mg/L | 94 | 42 | 0.300 mg/L | 5 | 0.047 | 0.992 |
| Outside Nitrate mg/L | 94 | 64 | 10 mg/L | 43 | 8 | 27 |
| Outside Hardness mg/L | 92 | 92 | None | N/A | 327 | 425 |
| Inside Arsenic µg/L | 21 | 7 | 10 µg/L<br>No safe amount | 0 | 1.17 | 2.43 |
| Inside Lead µg/L | 94 | 33 | 15 µg/L<br>No safe amount | 2 | 1.0 | 30.0 |
| Inside Manganese mg/L | 16 | 4 | 0.300 mg/L | 2 | 0.153 | 0.483 |
| Inside Nitrate mg/L | 57 | 56 | 10 mg/L | 28 | 9.5 | 27.1 |
| Inside Hardness mg/L | 90 | 90 | None | N/A | 149 | 425 |

mg/L milligrams of chemical per liter of water equivalent to parts per million (ppm)
µg/L micrograms of chemical per liter of water equivalent to parts per billion (ppb)
< less than (result is below the level that the laboratory can report)
N/A not applicable
* 250 mg/L is not a health standard but indicates when the water may start to taste salty

## Arsenic

Arsenic occurs naturally in rocks and soil and dissolves into groundwater. Arsenic in drinking water is linked to increased risk of cancers of the bladder, lungs, liver, and other organs. High levels of arsenic in drinking water can also contribute to cardiovascular and respiratory disease, reduced intelligence in children, and skin problems, such as lesions, discoloration, and the development of corns. The drinking water guideline for arsenic is 10 µg/L, but the US Environmental Protection Agency goal for arsenic in drinking water is 0 µg/L since prolonged exposure to any level of arsenic can increase the risk of cancer.

### Results and findings

- Arsenic was found in 16% (15 of 94 wells) of the outside samples and in 33% (7 of 21 wells) of the inside samples. None of the sampled wells exceeded the drinking water guideline of 10 µg/L.
- Effectiveness of water treatment by Reverse Osmosis (RO) systems was variable ranging from 2% to 37% arsenic reduction. Some existing RO systems can have an additional filter installed to reduce arsenic.
- Arsenic is statistically correlated with manganese, when one is present the other is likely to be present.
- Arsenic concentrations are higher in shallower wells and decrease with increasing well depth. Statistical analysis was performed on the 59 of 94 wells that have a well construction record on file at the County or the MN Geological Survey.

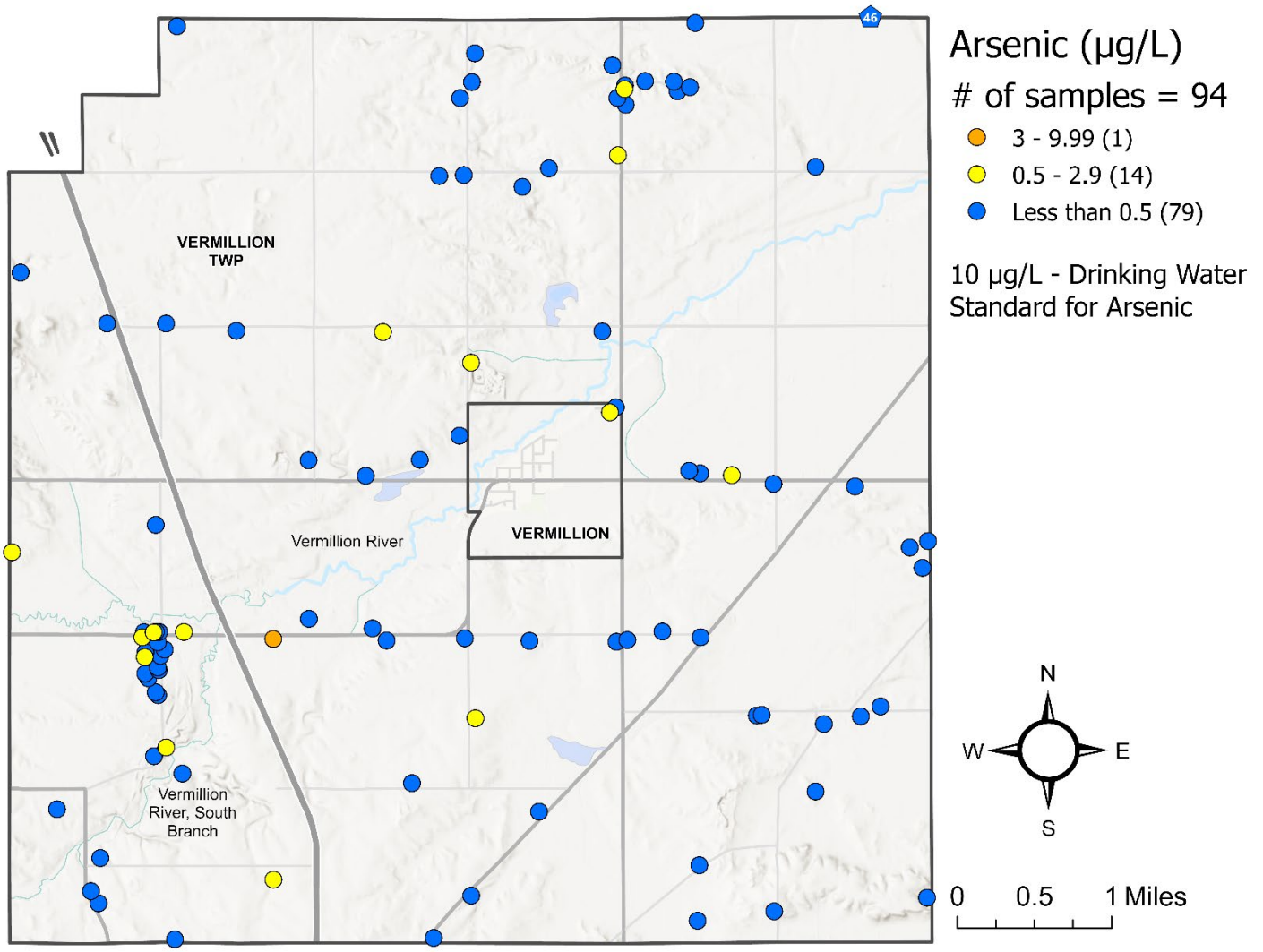


Figure 1. Arsenic results in untreated water from outside spigot

## Manganese

Manganese occurs naturally in rocks and soil and dissolves into groundwater. Our bodies need a small amount of manganese to maintain health, and we get enough manganese from the foods we eat. However, research indicates that children and adults who drink water with high levels of manganese for a long time may develop problems with memory, attention, and motor skills. Infants are more vulnerable to the effects of manganese. For infants who drink well water or formula made with well water, manganese should not exceed 0.100 mg/L. For everyone else, the level of manganese should not exceed 0.300 mg/L. Non-health related problems (metallic taste and staining plumbing fixtures) may occur above 0.050 mg/L.

### Results and findings

- Manganese was found in 45% (42 of 94 wells) of the outside samples and in 25% (4 of 16 wells) of the inside samples. Manganese was detected in two wells above the drinking water guideline of 0.300 mg/L in the inside water sample.
- Manganese is statistically correlated with arsenic, when one is present the other is likely to be present.
- Manganese concentrations are lowers in shallower wells and increase with increasing well depth. Statistical analysis was performed on the 59 of 94 wells that have a well construction record on file at the County or the MN Geological Survey.

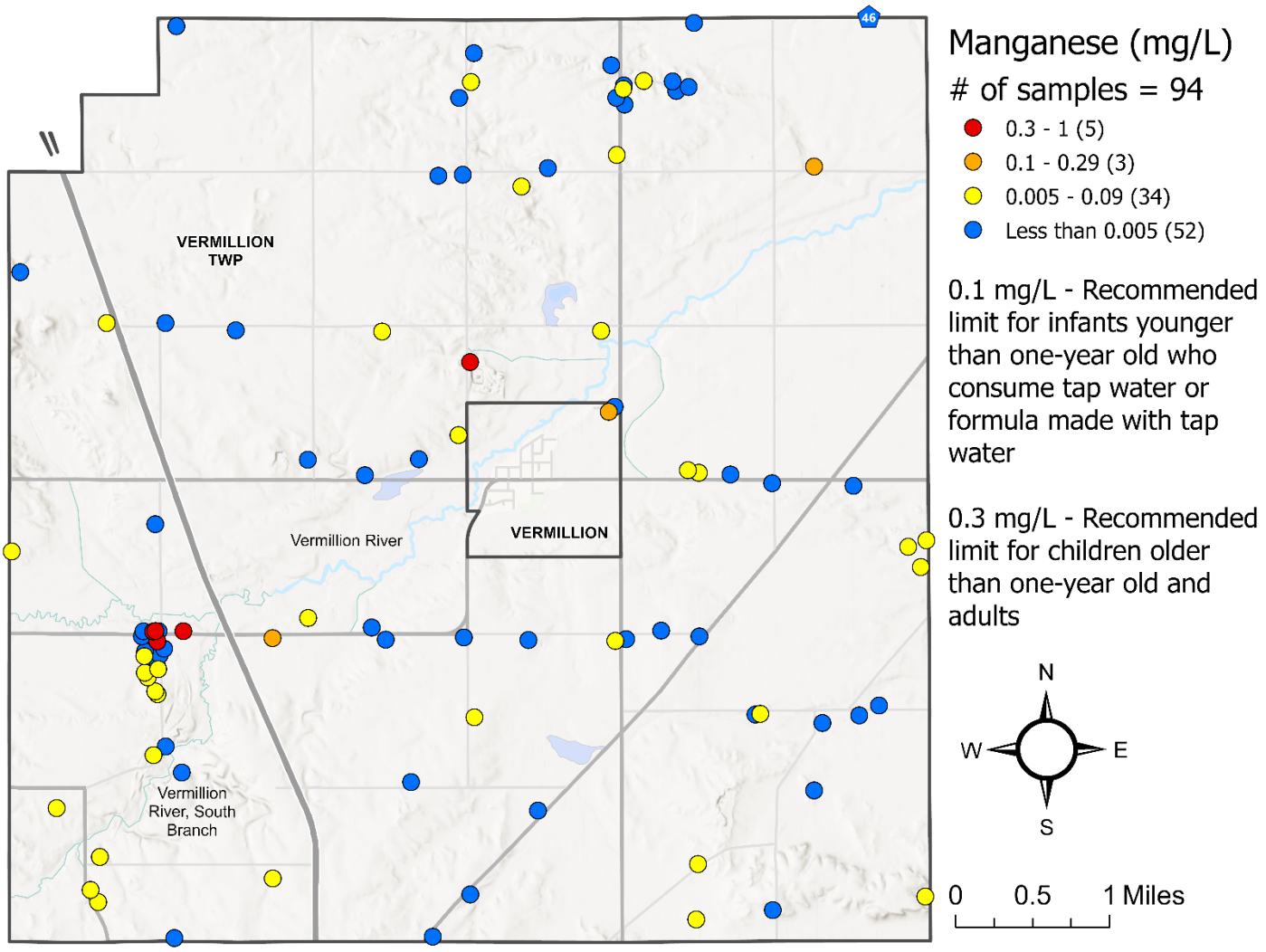


Figure 2. Manganese results in untreated water from outside spigot

## Nitrate

Nitrate occurs naturally at very low levels. Nitrate in groundwater is usually associated with human activities including row crop agriculture, septic systems, and animal feedlots. In Dakota County, the major source is fertilizer used on agricultural crops, which leaches to the drinking water aquifers. A nitrate level above 10 mg/L in drinking water can be harmful to infants under six months old. Infants that consume water or formula mixed with water that is high in nitrate may develop "blue baby syndrome" (methemoglobinemia), a life-threatening condition. Adults may be susceptible to methemoglobinemia if they have certain health conditions. Always test for nitrate before giving well water to an infant. The presence of nitrate is a strong indication that herbicides or herbicide breakdown products are also present. Importantly, both nitrate and herbicides can be reduced using a water treatment device such as a reverse osmosis system (RO). Carbon filtration alone can reduce herbicide concentrations.

### Results and findings

- Nitrate was detected in 68% (64 of 94) of the outside samples; 46% (43 of 94) exceeded the guideline of 10 mg/L.
- Nitrate exceeded the drinking water guideline in 49% (28 of 57 wells) in inside drinking water tap samples.
- Effectiveness of treatment by Reverse Osmosis (RO) systems was variable ranging from 38% to 100% reduction.
- Nitrate is statistically correlated with chloride, which means when one occurs the other is likely to occur. Both are applied to the ground surface by human activities and impact our drinking water aquifers.
- Nitrate concentrations are higher in shallower wells and decreases with increasing well depth. Statistical analysis was performed on the 59 of 94 wells sampled that have a well construction record on file at the County.

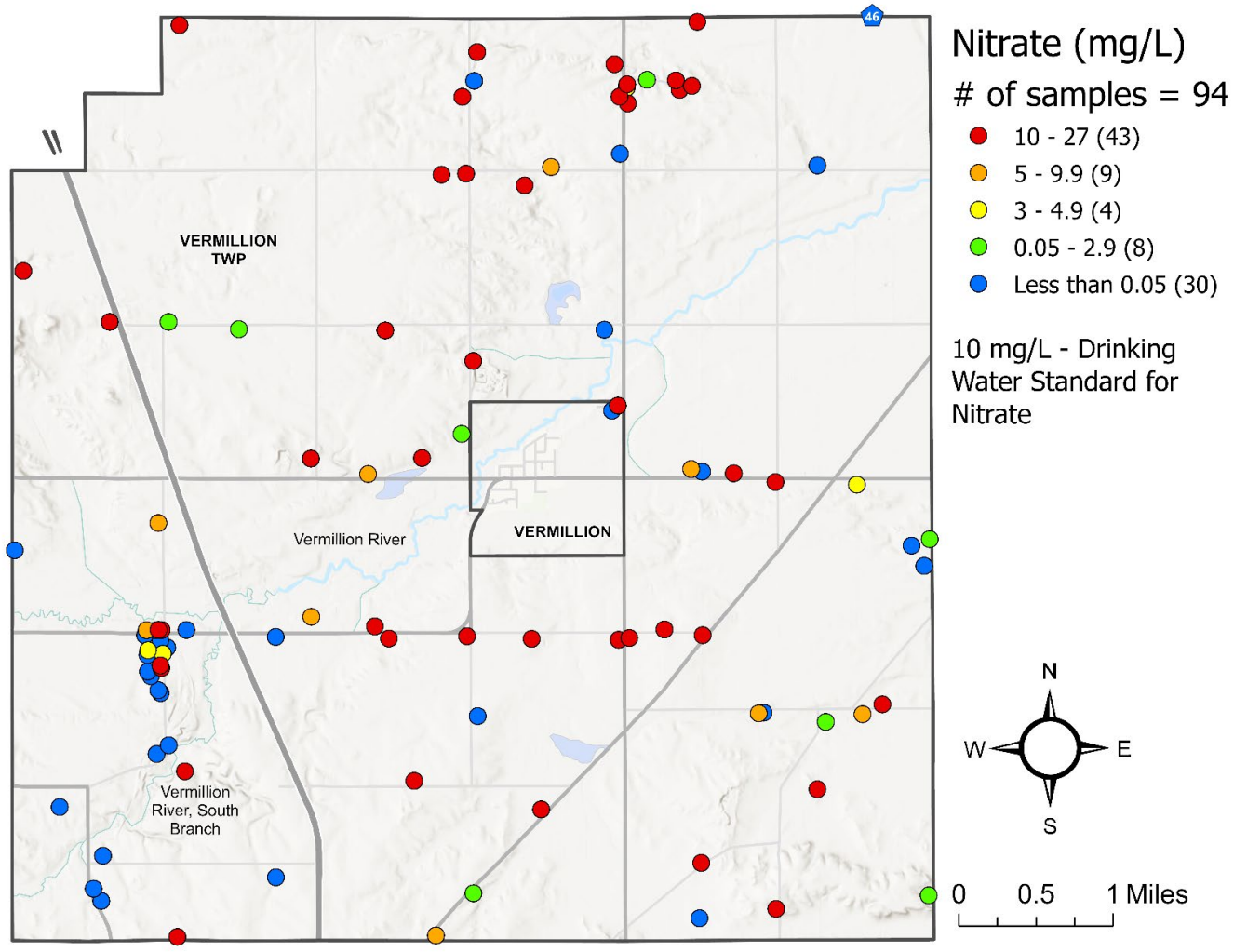


Figure 3. Nitrate results in untreated water from outside spigot

## Chloride

Chloride occurs naturally in the rocks and soil across Dakota County at very low levels. High levels of chloride in groundwater indicate contamination from the application of road salt, potash fertilizer, water softener brine discharge into septic systems, or deicing salt applied to sidewalks and parking lots. Elevated chloride can potentially leach metals, like lead, from plumbing into the drinking water. There is no health-based guideline for chloride, but the USEPA recommends levels no higher than 250 mg/L to avoid undesirable tastes (saltiness). Chloride detected in well water indicates that the well is vulnerable to surface contamination.

### Results and findings

- Chloride was found in 70% (66 of 94 wells) of the outside samples, the highest result was 107 mg/L. Chloride levels are higher in shallow wells and decrease with increasing well depth. Statistical analysis was performed on the 59 of 94 wells that have a well construction record on file at the County or the MN Geological Survey.
- Chloride is statistically correlated with nitrate, which means when one occurs the other is likely to occur. Both are applied to the ground surface by human activities and impact our drinking water aquifers.

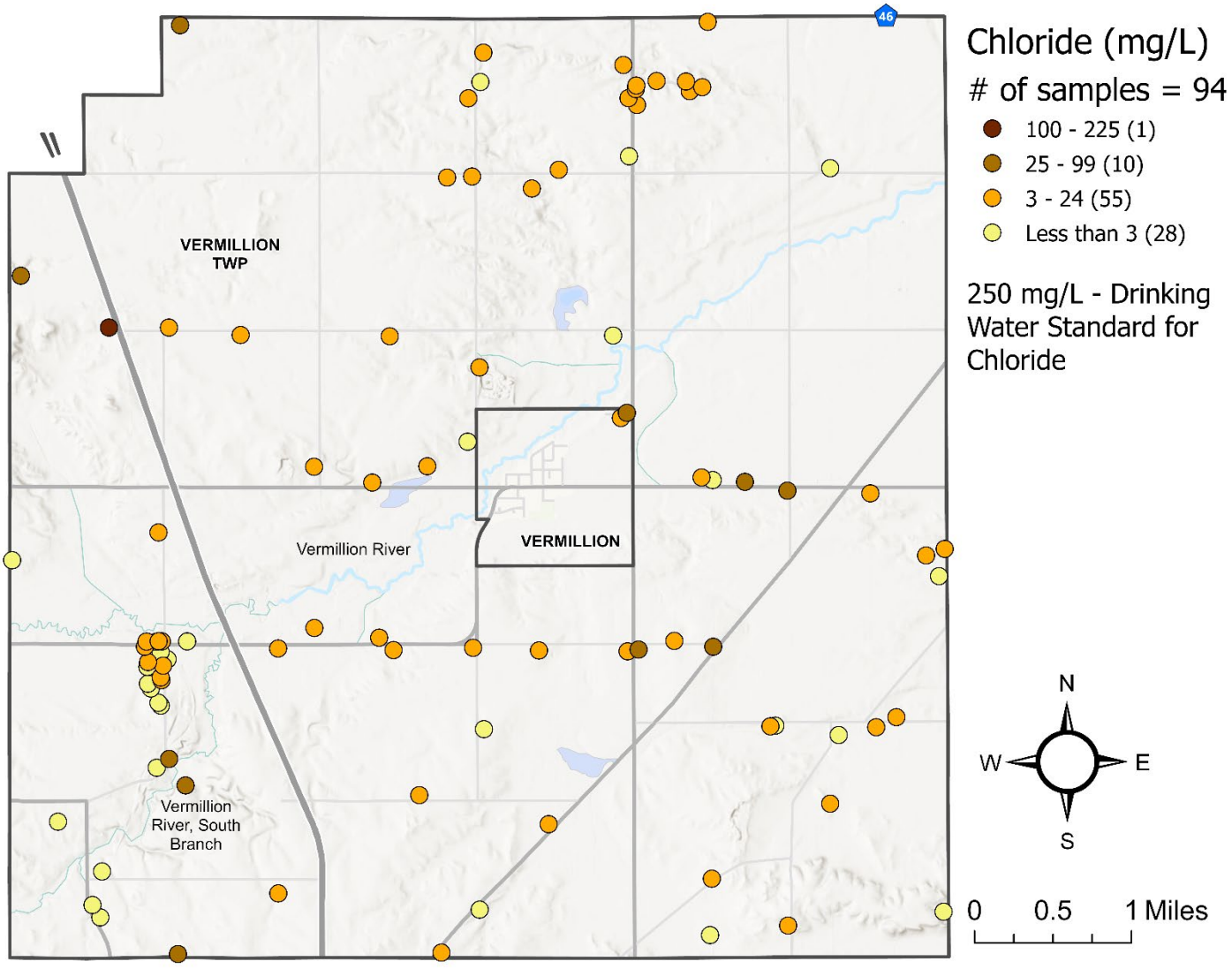


Figure 4. Chloride results in untreated water from outside spigot

## Lead

Lead rarely occurs naturally in groundwater. Lead can leach into drinking water from lead pipes; lead solder on copper pipes; and brass faucets, fittings, and valves (including those advertised as lead-free). Brass fixtures, including fixtures that don't look like brass, such as chrome plate brass products, can contribute lead to drinking water. The USEPA federal drinking water guideline for lead is 15 µg/L, however, there is no safe level of lead. Lead exposure usually has no obvious health symptoms and can go unrecognized. Health concerns include impaired physical and mental development, hearing problems, and damage to the brain, kidneys, red blood cells, and nervous system. Pregnant women, infants, and children under six years of age are at the highest risk. The federal "Reduction in Lead in Drinking Water Act" (2014) reduced the amount of lead allowed in water systems and plumbing products by changing the definition of "lead free" from 8% lead content to not more than 0.25% lead in drinking water plumbing components.

### Results and findings

- All samples collected from the inside primary drinking water tap were tested for lead. Lead was detected in 35% (33 of 94) of the samples. Two samples exceeded 15 µg/L, the drinking water guideline for lead; however, no amount of lead is safe to drink. When purchasing a water treatment device look for one that is certified to reduce lead.

## If drinking water has elevated levels of chemicals, do the following:

- ✓ Prepare infant formula with bottled water.
- ✓ **Do not boil** drinking water. Boiling water may concentrate contaminants, but it is effective at killing bacteria.
- ✓ **Identify** and, if possible, **remove** sources of contamination near the well. Fertilizers, animal wastes and sewage systems should be located far from the well and managed to avoid contamination. The top of the well should be at least 12 inches above the surrounding dirt or landscaping.
- ✓ **Install** a NSF, UL, or WQA certified water treatment system and **maintain** it annually. No single treatment process can remove all substances in water. If there are several substances you want removed from your water, you may need to combine treatment processes. The MN Dept. of Health website has information on water treatment at http://www.health.state.mn.us search water treatment.
- ✓ **Continue sampling**. Test your drinking water after you install treatment because there is often no other way to know if a treatment system is working properly. To test for common chemicals of concern, you can have a water test kit mailed to you by requesting one online at www.co.dakota.mn.us search well testing.
- ✓ A **Coliform Bacteria** test is recommended annually for private wells. Coliform bacteria was not tested as part of this study. Consider testing; see directions on how to get a test kit, below.

## We can help

- Dakota County may have a copy of your original well record on file if the well was drilled after 1975. The well record can tell you the aquifer your well is tapping and assist a well contractor who may do future work on your well. To request your well record, go to: www.co.dakota.mn.us, Search Well Information
- If you choose to install a new well and will no longer be using your existing well, the old well will need to be sealed by a MN licensed well contractor. Dakota County may have grant funds available (usually 50% of the cost to seal the well). The application is located at: www.co.dakota.mn.us, Search Well Sealing Grant.

## Further testing

Request a sample kit online from Dakota County at www.co.dakota.mn.us, Search: Water Test. Available tests include Coliform Bacteria, Nitrate, Arsenic, Manganese, Lead, and Fluoride.

## Contact

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