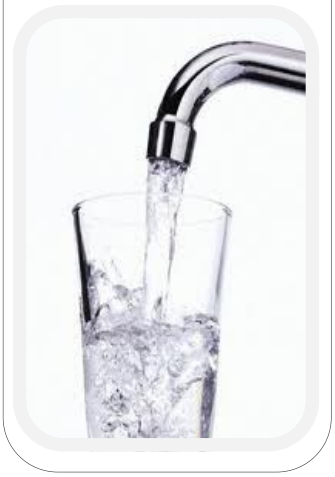
Dakota COUNTY

Physical Development Division
Environmental Resources Dept.
Groundwater Protection Unit



FACT SHEET
MARSHAN TOWNSHIP PRIVATE WELL SAMPLING IN 2020

WHY WERE WELLS TESTED?

The purpose of this study was to evaluate the drinking water quality in private wells located in Marshan Township in Dakota County, Minnesota. Water samples were tested for the presence of geologically sourced (naturally occurring) manganese and arsenic, as well as human-caused chloride and nitrate. Previous sampling of private wells in Marshan found that both nitrate and pesticides are detected at levels that exceed drinking water guidelines. The sandy coarse-textured soils help contaminants travel quickly to the groundwater which is the source of drinking water for residents.

STUDY APPROACH

The County mailed sample bottles to 387 private well owners in Marshan Twp; 38% (146 of 387) participated. 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 milligrams per liter (mg/L) for nitrate, 0.05 micrograms per liter (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 used on the water sample collected from the inside tap.

TABLE 1. SUMMARY OF WATER TEST RESULTS

	Chemical (units)	# of well samples	Detections # of samples (%)	Drinking Water Guideline (DWG)	Samples above DWG # of samples (%)	Mean (Average)	Maximum
Outside Sample (Untreated)	Arsenic (µg/L)	146	55 (38%)	10 µg/L No amount is safe	0 (0%)	0.93	8.87
	Chloride (mg/L)	146	113 (77%)	250 mg/L*	0 (0%)	15.1	80.5
	Manganese (mg/L)	146	30 (21%)	0.100 mg/L (Infant < 1yr)	4 (3%)	0.023	0.571
				0.300 mg/L (All Others)	1 (<1%)		
	Nitrate (mg/L)	146	105 (72%)	10 mg/L	85 (58%)	9.58	34.50
	Hardness (mg/L)	146	146	None	NA	365	425
Inside Sample (May be treated or untreated)	Arsenic (µg/L)	55	17 (31%)	10 µg/L No amount is safe	0 (0%)	0.66	1.91
	Lead (µg/L)	146	15 (10%)	15 µg/L No amount is safe	0 (0%)	0.6	4.3
	Manganese (mg/L)	8	3 (38%)	0.300 mg/L (All Others)	1 (13%)	0.110	0.746
	Nitrate (mg/L)	132	88 (67%)	10 mg/L	31 (23%)	5.73	24.40
	Hardness (mg/L)	146	146	None	NA	177	425

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

µg/L - micrograms of chemical per liter of water equivalent to parts per billion (ppb)
NA - not applicable

Hardness—Water softeners are effective at reducing manganese, copper and radium levels. Testing for radium is expensive. Radium is present in private wells in Dakota County, No amount of radium is safe. Consider installing a high efficiency water softener that will use less salt and is certified to reduce radium to treat the water to your primary drinking water tap.

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CHEMICAL CONTAMINANT INFORMATION & SIGNIFICANT FINDINGS

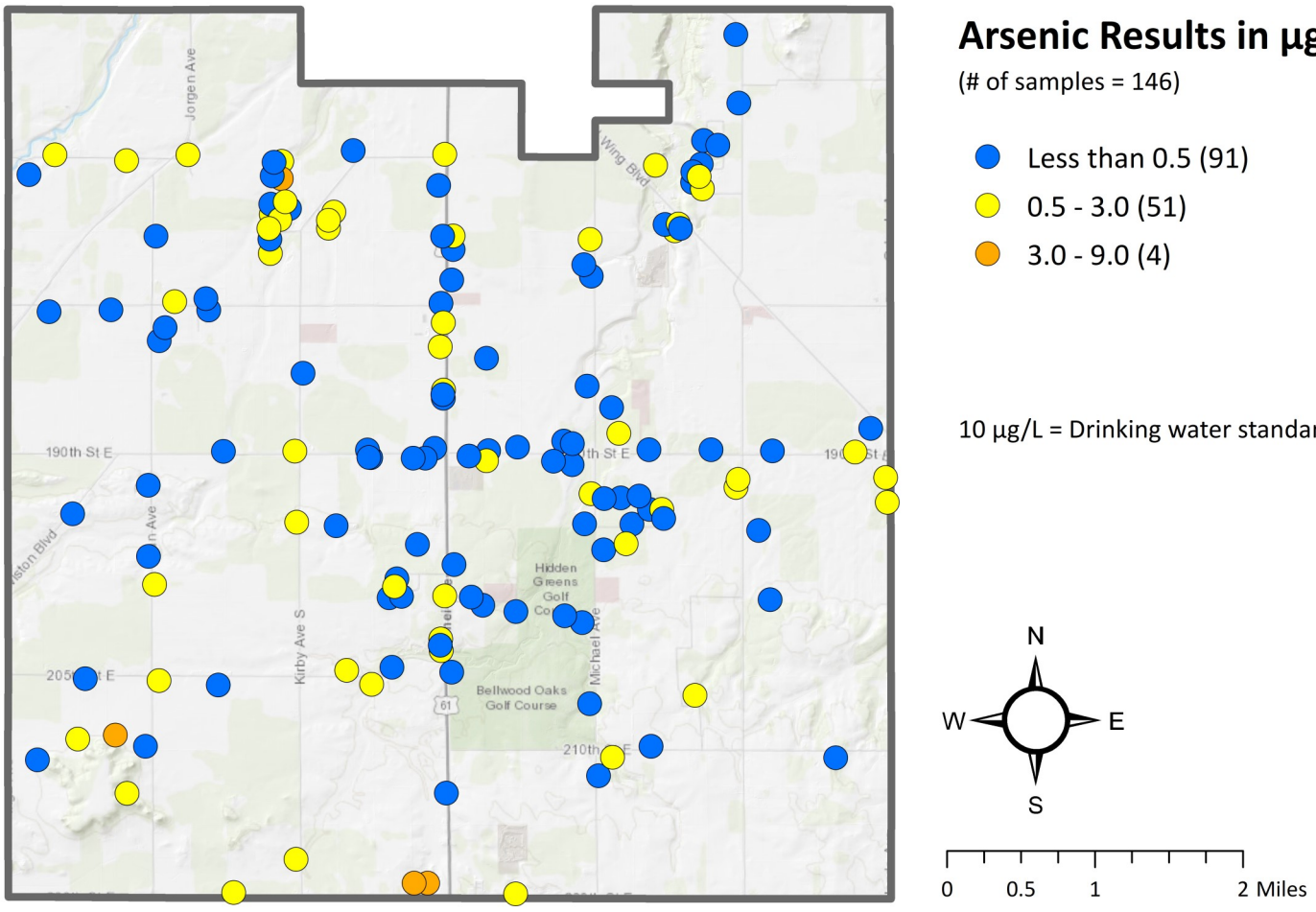
Arsenic: occurs naturally in rocks and soil and dissolves into groundwater. Arsenic in drinking water is linked to increased risk of cancers of the bladder, lungs, liver, and other organs. High levels of arsenic in drinking water can also contribute to cardiovascular and respiratory disease, reduced intelligence in children, and skin problems, such as lesions, discoloration, and the development of corns. The drinking water guidelines 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 risks of cancer.

Results and Findings:

- Arsenic was found in 38% (55 of 146 wells) of the outside samples and in 31% (17 of 55 wells) of the inside samples. None of the sampled wells exceeded the drinking water guideline of 10 µg/L.
- 24 households with water treatment by Reverse Osmosis (RO) system reduced low levels of arsenic of less than 2 µg/L to below 0.5 µg/L. The highest arsenic level treated with RO of 5.13 µg/L was reduced to 1.82 µg/L, a 65% arsenic reduction. Some existing RO systems can have an additional filter installed to reduce arsenic .
- Arsenic is statistically correlated with manganese, which means when one is present the other is likely to be present.
- Statistical analysis was performed on the 96 of 146 wells that have a well construction record on file at the County or the MN Geological Survey. There is no relationship between well depth and arsenic levels.

Arsenic exists in different forms and may require specialized treatment systems to remove completely. No amount of arsenic is safe.

FIGURE 1. ARSENIC RESULT IN UNTREATED WATER FROM OUTSIDE SPIGOT



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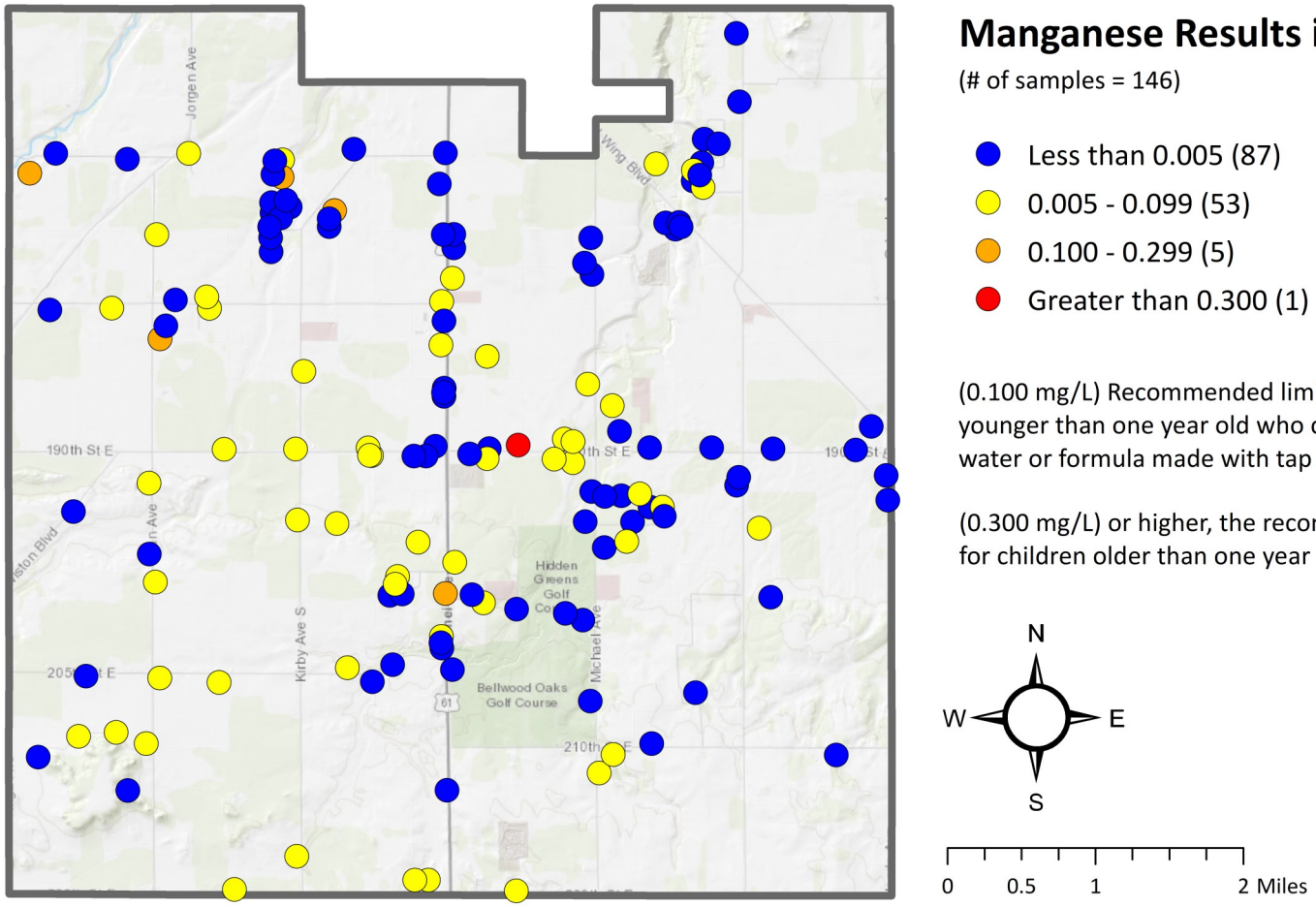
Manganese: occurs naturally in rocks and soil and dissolves into groundwater. Our bodies need a small amount of manganese to maintain health, and we get enough manganese from the foods we eat. However, research indicates that children and adults who drink water with high levels of manganese for a long 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 detected in four wells above the drinking water guideline of 0.100 mg/L for infants one year or younger in outside water sample, and one of those samples exceeded 0.300 ug/L the guideline for everyone of all ages, in both the outside and inside drinking water sample.
- Manganese is statistically correlated with arsenic, which means when one is present the other is likely to be present.
- Manganese concentrations increase in deeper wells and decrease with decreasing well depth. Statistical analysis was performed on the 96 of 146 wells that have a well construction record on file at the County or the MN Geological Survey.
- Manganese levels in wells completed in the Jordan Aquifer are higher and statically different from the manganese levels in wells in the Prairie du Chien aquifer, screened wells in the sand and gravel, and in wells where the aquifer the well is completed in is unknown.

FIGURE 2. MANGANESE RESULT IN UNTREATED WATER FROM OUTSIDE SPIGOT



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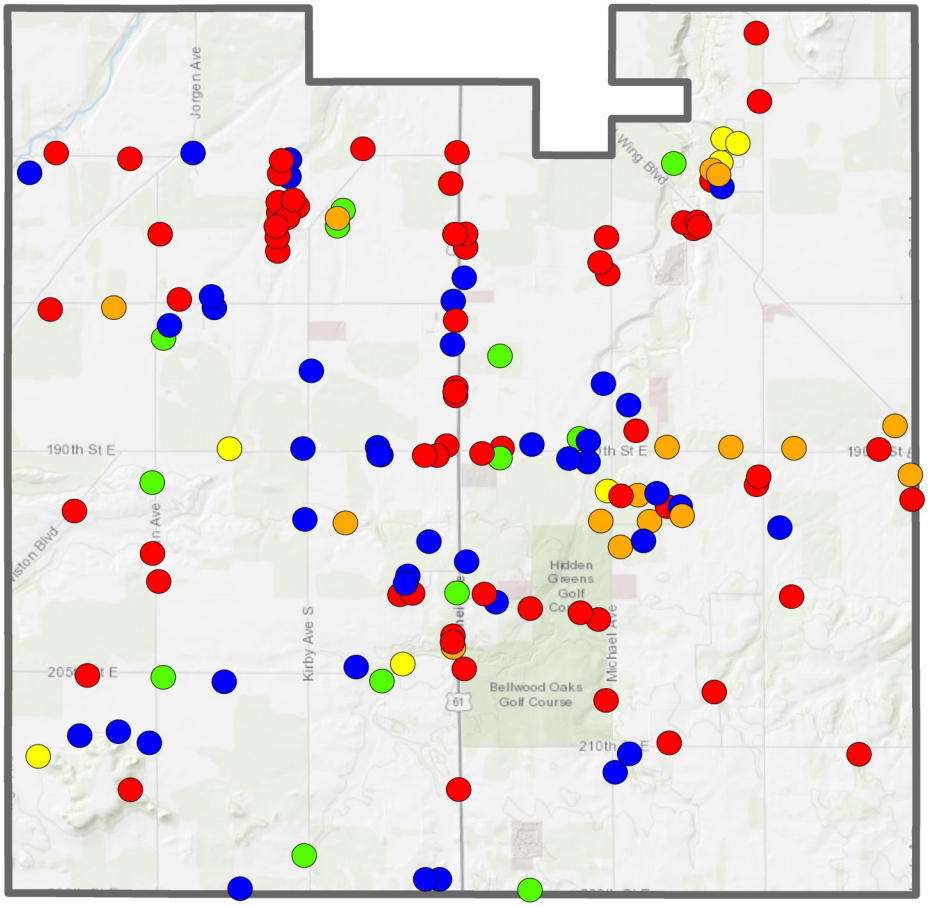
Nitrate: occurs naturally at very low levels. Nitrate in groundwater is usually associated with human activities including row crop agriculture, septic systems, and animal feedlots. In Dakota County, the major source is fertilizer used on agricultural crops, which leaches to the drinking water aquifers. 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. There is a significant relationship between the detection and levels of nitrate and herbicides. **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 by the use of a water treatment device such as reverse osmosis system (RO). Carbon alone can reduce herbicide concentrations.

Results and Findings:

- Nitrate was detected in 72% (105 of 146 wells) of the outside samples; 58% (85 of 146) of wells exceed the drinking water guideline of 10 mg/L, the highest outside nitrate level is 34.5 mg/L and the highest indoor nitrate level is 24.4 mg/L..
- Effectiveness of water treatment by Reverse Osmosis (RO) systems was as high as a 99% nitrate reduction; the average nitrate reduction was 64%.
- One household uses distillation to treat the well water which reduced the nitrate level by 99%.
- 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 the drinking water aquifers.
- Nitrate concentrations are higher in shallower wells and decrease with increasing well depth. Statistical analysis was performed on the 96 of 146 wells that have a well construction record on file at the County or the MN Geological Survey.
- Nitrate levels in wells completed in the Jordan Aquifer (typically the deepest aquifer used in Marshan Twp) are lower and statically different from the nitrate levels in wells in the Prairie du Chien aquifer, screened wells in the sand and gravel, and in wells where the aquifer the well is completed in is unknown.

FIGURE 3. NITRATE RESULT IN UNTREATED WATER FROM OUTSIDE SPIGOT



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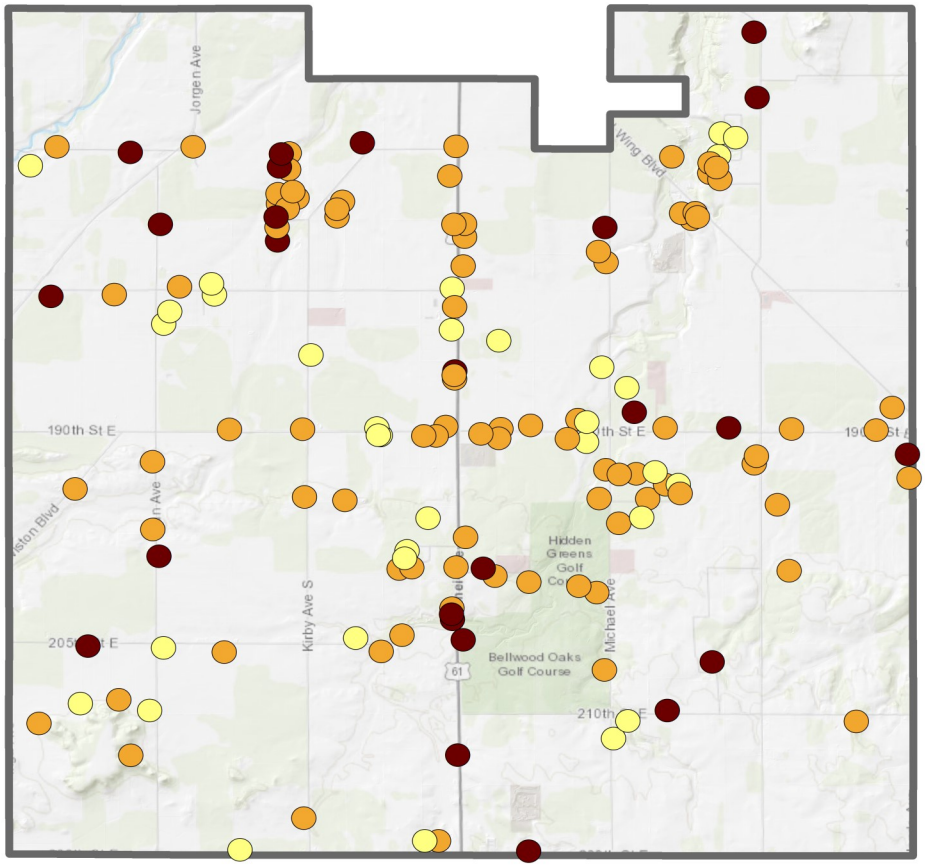
Chloride: occurs naturally in the rocks and soil across Dakota County at very low levels. High levels of chloride in groundwater indicate contamination from the application of road salt, potash fertilizer, water softener brine discharge into septic systems, or deicing salt applied to sidewalks and parking 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:

- Chloride was found in 77% (113 of 146 wells) of the outside samples, the highest result was 80.5 mg/L. Chloride levels are higher in shallow wells and decrease with increasing well depth. Statistical analysis was performed on the 96 of 146 wells that have a well construction record on file at the County or the MN Geological Survey.
- 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 the drinking water aquifers.

FIGURE 4. CHLORIDE RESULT IN UNTREATED WATER FROM OUTSIDE SPIGOT



Chloride Results in mg/L

(# of samples = 146)

- Less than 3 (33)
- 3 - 25 (88)
- 25 - 100 (25)

250 mg/L = Drinking water standard for Chloride

N
W E
S

0 0.5 1 2 Miles

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:

- All samples collected from the inside primary drinking water tap were tested for lead. Lead was detected in 10% (15 of 146) of the samples. None of the 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.

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The water testing was funded by Dakota County.

If your water has elevated levels...

⇒⇒ **Prepare infant formula with bottled water.**

⇒⇒ **Do not boil your drinking water.** Boiling water may concentrate contaminants. However, it may be effective at killing bacteria.

⇒⇒ **Remove contamination sources.** If possible, identify and 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 water treatment system.** We recommend hiring a state licensed water conditioning contractor to install water treatment systems. Remember, treatment systems require annual maintenance for effective operation. No single treatment process can remove all substances in water. If you decide to install a home water treatment unit, the unit (or units) you choose should be certified by NSF, UL, or WQA, and specifically labeled to reduce or remove the contaminant you are concerned about. (However, devices are not certified for manganese removal at this time.) If there are several substances you want removed from your water, you may need to combine several treatment processes.

⇒⇒ **Continue sampling and maintain your system.** You should continue to test your drinking water after you install a treatment unit because there is often no other way to know if a treatment system is working properly. All home water treatment units require regular maintenance to work properly.

⇒⇒ **Coliform Bacteria Test.** A coliform bacteria test is recommended annually for private wells. Coliform bacteria was not tested for as part of this study. Consider testing; see directions on how to get a test kit, below.

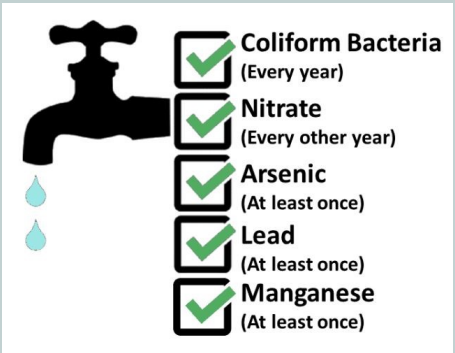
We can help.

⇒⇒ Dakota County may have a copy of the original well record for your well on file if the well was drilled since 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.dakotacounty.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 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.dakotacounty.us Search *Well Sealing Grant*

Further Testing

Request water sample bottles from Dakota County by calling (952) 891-7000 or ordering from www.dakotacounty.us Search: *Water Test.*



Dakota County Groundwater Study

Learn more about the County's drinking water aquifers and water quality like nitrate, arsenic, manganese, chloride, pesticides and industrial chemicals including the 3M chemicals, go to:

www.dakotacounty.us

search

Ambient Study