

# 2019 Source Water Assessment

CITY OF FAIRMONT PUBLIC WATER SYSTEM

PWS ID # 1460003



**2019 Source Water Assessment – City of Fairmont  
Public Water Supply ID: 1460003**

City of Fairmont  
100 Downtown Plaza  
Fairmont, Minnesota 56031  
507-238-9461  
<http://fairmont.org>

Prepared by:  
Minnesota Department of Health  
Drinking Water Protection – Source Water Protection  
PO Box 64975  
St. Paul, Minnesota 55164-0975  
651-201-4700  
[health.drinkingwater@state.mn.us](mailto:health.drinkingwater@state.mn.us)  
[www.health.state.mn.us](http://www.health.state.mn.us)

*Upon request, this material will be made available in an alternative format such as large print, Braille or audio recording. Printed on recycled paper.*

# Contents

Contact Information.....	iv
Glossary.....	v
Abbreviations.....	vii
Introduction to the Source Water Assessment .....	1
Background .....	1
Contributors to the SWA.....	1
Purpose of the SWA.....	1
Source Water Characteristics.....	1
Infrastructure Characteristics .....	2
Watershed Areas Delineated for the Source Water Assessment.....	4
Emergency Response Area .....	4
Spill Management Area.....	4
Drinking Water Supply Management Area – Surface Water .....	4
Source Water Assessment Area.....	5
Contaminants of Concern .....	7
Nitrate.....	9
Harmful Algal Blooms and Associated Toxins.....	12
Potential Contaminant Source Inventory .....	13
Emergency Response Area .....	14
Spill Management Area.....	15
Drinking Water Supply Management Area – Surface Water .....	17
Land Use.....	17
Emergency Response Area .....	17
Spill Management Area.....	17

Drinking Water Supply Management Area – Surface Water ..... 18

Summary of High-Priority Issues..... 19

Recommended Actions ..... 20

    Monitoring Source Water ..... 20

    Emergency Preparedness ..... 20

    Potential Contaminant Source Management..... 20

    Contaminant Conveyances and Potential Releases..... 20

    Non-Point Source Pollution and Land Management ..... 21

    Alternative Water Supply..... 21

    Surface Water Intake Protection Planning ..... 22

References ..... 23

List of Tables

Table 1 – Drinking Water Quality Results for City of Fairmont ..... 8

Table 2 – Historical Microcystin Sample Results ..... 13

Table 3 – Land Uses within Delineated Protection and Watershed Areas..... 18

List of Figures

Figure 1 – Fairmont Chain of Lakes and Dutch Creek with the DNR catchments for each. .... 3

Figure 2 – Fairmont’s Drinking Water Supply Management Area, Spill Management Area, and Emergency Response Area ..... 6

Figure 3 – Nitrate concentration measurements over time, as collected by the MDH nitrate measuring sonde..... 10

Figure 4 – Nitrate concentration data and calculated linear trends of data for Dutch Creek from 2000 through 2018. 2018 data is preliminary and subject to change. .... 11

Figure 5 – Average nitrate concentrations for MPCA monitored lakes in the Fairmont Chain of Lakes. Whisker lines represent the maximum (upper) and minimum (lower) observed nitrate concentrations for each year. .... 12

# Contact Information

## Intake Protection Plan Manager

Doug Rainforth  
Water and Wastewater Superintendent  
507-235-6789  
[drainforth@fairmont.org](mailto:drainforth@fairmont.org)

## State and Local Technical Assistance Planning Staff

Dereck Richter  
Minnesota Department of Health Source Water Protection Surface Water Program Planner  
651-201-4664  
[Dereck.Richter@state.mn.us](mailto:Dereck.Richter@state.mn.us)

Amanda Strommer  
Minnesota Department of Health Source Water Protection District Planner  
507-476-4241  
[Amanda.Strommer@state.mn.us](mailto:Amanda.Strommer@state.mn.us)

## State Hydrologist Staff

Tracy Lund  
Minnesota Department of Health Source Water Protection Surface Water Program Hydrologist  
651-201-4580  
[Tracy.Lund@state.mn.us](mailto:Tracy.Lund@state.mn.us)

Yarta Clemens-Billaigbakpu  
Minnesota Department of Health Source Water Protection District Hydrologist  
651-201-4686  
[Yarta.Clemens-Billaigbakpu@state.mn.us](mailto:Yarta.Clemens-Billaigbakpu@state.mn.us)

I hereby certify that this plan, document or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Geologist under the laws of the State of Minnesota.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Printed Name: Tracy Lund

License Number: 50716

# Glossary

**Agronomist** – An expert in the science of soil management and crop production.

**Appropriations** – The total amount of water approved for use from an aquifer, stream, lake, or reservoir by the Minnesota Department of Natural Resources.

**Aquatic consumption** – A standard that is applied to a body of water by the Minnesota Pollution Control Agency that differentiates whether fish caught in that waterbody should be consumed by people or not.

**Aquatic life use** – A standard that is applied to a body of water by the Minnesota Pollution Control Agency that describes whether the waterbody supports a healthy aquatic ecosystem or not.

**Aquatic recreation use** – A standard that is applied to a body of water by the Minnesota Pollution Control Agency that describes whether the waterbody supports or is impaired for recreational (i.e. swimming, boating, fishing, etc.) purposes.

**Buffer** – An area of equal width on either side of a stream.

**Centerline** – The center of a stream.

**Concentrations** – The abundance of an element or compound within a volume of water.

**Contaminant** – A chemical, either natural or man-made, that degrades water quality.

**Cyanobacteria** – A type of microorganism that obtains its energy through photosynthesis. Also known as Blue-Green Algae, they produce toxins that can be harmful if pets and humans come in contact with them.

**Cyanotoxins** – A toxin that is produced by cyanobacteria.

**Delineated area** – A watershed area that has been outlined as contributing to a downstream waterbody that serves as a public water supply source. The ERA, SMA, and DWSMA are all delineated areas.

**Dilution** – The action in which a chemical concentration is reduced in water by increasing the amount of water present.

**Disinfectant** – Any oxidant, including but not limited to chlorine dioxide, chloramines, and ozone, added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms.

**Disinfection byproduct (DBP)** – A chemical that is formed from a reaction between a disinfectant and organic matter that is present in water.

**Eutrophication** – A process through which a waterbody is enriched with excess nutrients, commonly from surface water runoff, which results in dense plant growth and decreased oxygen at depth.

**Fecal coliform** – A type of bacteria that is found in animals, humans, and transmitted to the natural environment.

**Geography** – Physical features of a described land area.

**Gradient** – The degree of slope of a surface, either of the land or water table.

**Infrastructure** – The physical structures and facilities that are needed for a public water supply's operation.

**Inorganic chemical** – Metals, salts, or other compounds that typically do not contain carbon.

**Intake** – A pipe located in a waterbody from which a public water supplier pumps their raw water for treatment.

**Lakeshed** – An area surrounding a lake that contributes water via runoff, groundwater, or stream flow.

**Lime Sludge** – A semi-solid material that is a byproduct of using lime during a water treatment process.

**Microorganism** – An organism that can only be seen with the use of a microscope.

**Mitigate** – Decrease in severity.

**Organic chemical** – A compound that contains carbon.

**Perennial stream** – A reoccurring or year round stream flow.

**Photosynthesis** – The process by which a plant uses sunlight in combination with carbon dioxide and water to create food for itself.

**Radionuclides** – An element that decays radioactively, emitting radiation as a result.

**Toxin** – Poison from plant or animal origin.

**Watershed** – An area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.

# Abbreviations

**DBPs** – Disinfection By-Products

**DNR** – Department of Natural Resources

**DWSMA-SW** – Drinking Water Source Management Area – Surface Water

**EPA** – U.S. Environmental Protection Agency

**ERA** – Emergency Response Area

**GAC** – granular activated carbon

**HAB** – Harmful Algal Bloom

**HUC** – Hydrologic Unit Code

**KML** – Keyhole Markup Language

**LiDAR** – Light Detection and Ranging

**MCL** – Maximum Contaminant Level

**MDA** – Minnesota Department of Agriculture

**MDH** – Minnesota Department of Health

**mg/L** – milligrams per liter

**MN** – Minnesota

**MGY** – millions of gallons per year

**MNDWIS** – Minnesota Drinking Water Information System

**MnGEO** – Minnesota Geospatial Information Office

**MPARS** – Minnesota Permitting and Reporting System

**MPCA** – Minnesota Pollution Control Agency

**MPN/100 mL** – Most probable number of organisms per 100 milliliters of solution

**NHD** – National Hydrography Dataset

**NRCS** – Natural Resource Conservation Services

**NTU** – Nephelometric Turbidity Units

**NWI** – National Wetland Inventory

**PCBs** – Polychlorinated Biphenyls

**PCSI** – Potential Contaminant Source Inventory

**ppb** – parts per billion

**ppm** – parts per million

**PWS** – Public Water Supplier

**PWSs** – Public Water Suppliers

**SDWA** – Safe Drinking Water Act

**SMA** – Spill Management Area

**SWA** – Source Water Assessment

**SWAs** – Source Water Assessments

**SWCD** – Soil and Water Conservation District

**SWIPP** – Surface Water Intake Protection Plan

**TTHM** – total trihalomethanes

**ug/L** – micrograms per liter

**USGS** – United State Geological Survey

# Introduction to the Source Water Assessment

## Background

The 1996 amendments to the federal Safe Drinking Water Act (SDWA) required the Minnesota Department of Health (MDH) to complete source water assessments (SWAs) or public water systems (PWS). The first source water assessment (SWA) for Fairmont was completed in 2003.

Since the first SWAs were completed, much has changed in the processes used to develop source water protection plans, as well as with the data and tools to support these efforts. For example, we now have more data available and use a more sophisticated method to characterize water quality. The water resource management framework in Minnesota has also changed substantially, most notably with a shift towards watershed-based comprehensive local water planning.

MDH has dedicated resources to update the SWA and to work with the PWS to create a Surface Water Intake Protection Plan (SWIPP). These documents will be used to drive implementation of activities to protect the source water for the city of Fairmont for the next ten years. After the 10 years have elapsed, MDH will reassess the PWS source water assessment area. This updated SWA will then guide the amended SWIPP.

## Contributors to the SWA

MDH, in partnership with the Fairmont Public Utilities Commission, assembled a team of staff from MDH, the city of Fairmont, and the Martin County Soil and Water Conservation District (SWCD) to develop and review this SWA.

## Purpose of the SWA

The information from this updated and enhanced assessment can be used in efforts to expand upon activities to prevent or mitigate contamination of Fairmont's source of drinking water.

The SWA provides information regarding the drinking water sources for public water systems. A SWA includes information on the following: identification of the resource used as a drinking water source, its physical setting, public water system intake and treatment, contaminants of concern, and known threats.

## Source Water Characteristics

The city of Fairmont obtains its public water supply from Budd Lake, which is part of the Fairmont Chain of Lakes (Figure 1). The Chain of Lakes is within the Blue Earth River Watershed (HUC8: 07020009). Flow through the Chain of Lakes proceeds from south to north in the following order: North Silver Lake, Wilmert Lake, Mud Lake, Amber Lake, Hall Lake, Budd Lake, Sisseton Lake, and

George Lake. Also feeding into the Chain, mostly upstream of Hall Lake, are Dutch Creek and several public ditches. Luedtke Slough, which is located to the southeast of Budd Lake, is also connected to Budd Lake via groundwater and two engineered stormwater outfall connections to Budd and Hall Lakes. The total watershed area above and including Budd Lake is approximately 26,400 acres.

<b>Source Watershed Statistics for the City of Fairmont</b>	
Watershed Area:	26,405 acres
Lake Area:	2,021 acres (10 Lakes)
Stream Length:	27.9 miles (30 Stream Reaches)
Wetland Area:	623 acres (245 Wetlands <sup>1</sup> )

<sup>1</sup>Wetland information is based on Department of Natural Resources (DNR) National Wetland Inventory (NWI) data

## Infrastructure Characteristics

The following list describes the key infrastructure components and permit capacity to provide safe and reliable water for residents and businesses in the city of Fairmont. The city maintains a partial backup well source (Minnesota Well Unique Number 144122) which can be blended with raw water from Budd Lake. The backup well is not intended to be relied upon as a full-scale backup, as its water chemistry includes naturally-occurring contaminants, such as radium, arsenic, and manganese, which may require changes in treatment. However, extreme circumstances would allow exclusive groundwater usage for short periods based on the current groundwater appropriation.

<b>Public Water System Characteristics</b>	
Intake Location and Method:	Three pipes extend into Budd Lake and terminate at two different depths.
Treatment Facility:	One treatment facility near intake on Budd Lake.
Treatment Methods:	Softening, particulate removal, backwash recycle, taste and odor control (adsorption contactor (granular activated carbon)), disinfection, fluoridation, corrosion control.
Production:	Max daily production of (up to) 5.4 million gallons, average daily 1,259,000 gallons (Minnesota Drinking Water Information System (MNDWIS))
Storage Capacity:	4.8 million gallons tank and tower storage + 0.4 million gallons treatment plant storage.
Backup Water Sources:	The city’s well (Unique No. 144122) is a backup water source and can be blended with surface water when needed. This source cannot be counted on as a full backup for an extended period.
DNR Appropriations Permit:	Surface water (Minnesota Permitting and Reporting System (MPARS) No. 1990-4146): 680 millions of gallons per year (MGY) permitted, Maximum Use last 5 years: 453.5 MGY in 2018; 5-year average: 439 MGY Groundwater (MPARS No. 1987-4300): 180 MGY permitted, Maximum Use last 5 years: 26.4 MGY in 2016; Annual discharge has usually been < 1 MGY

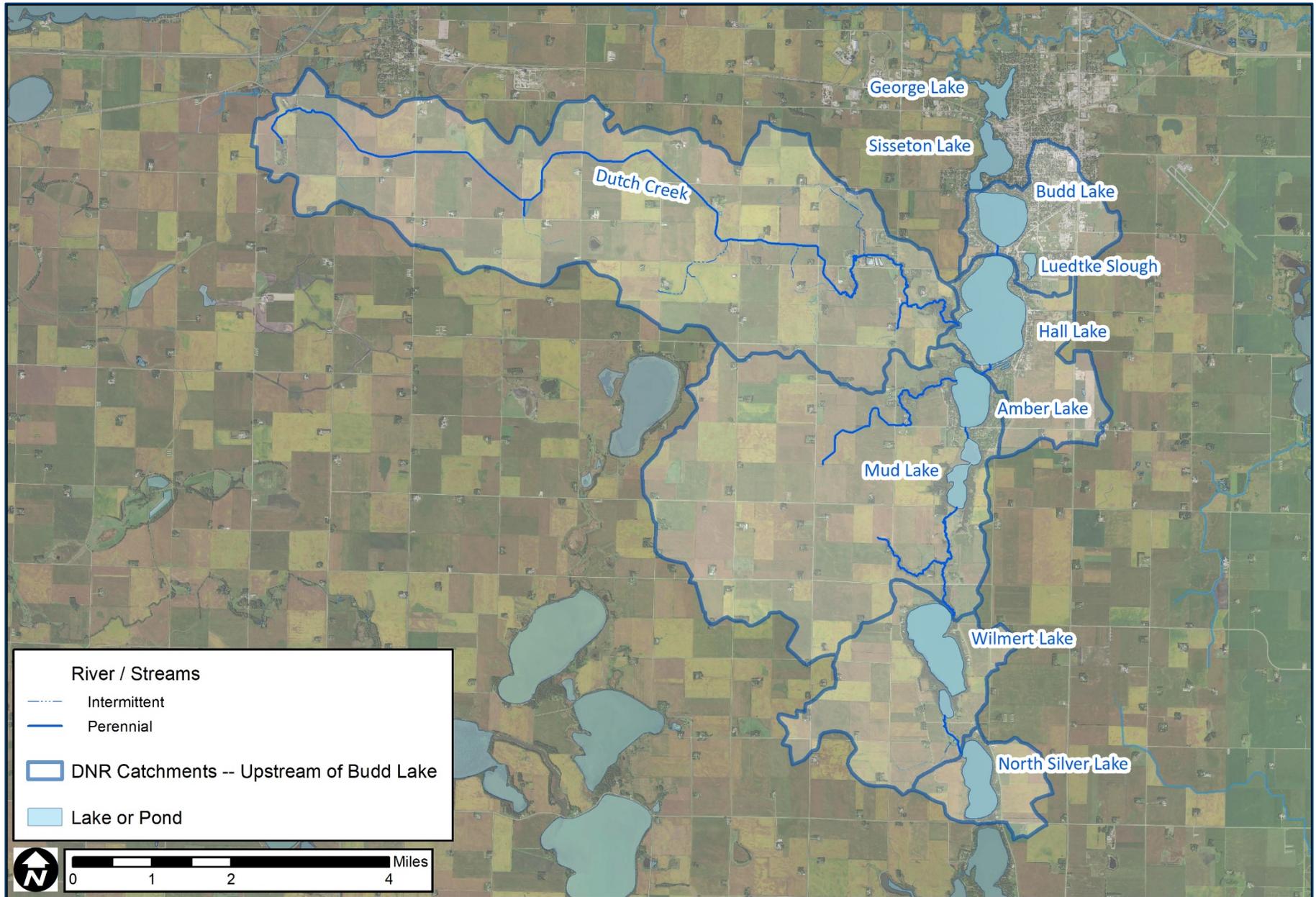


Figure 1 – Fairmont Chain of Lakes and Dutch Creek with the DNR catchments for each.

# Watershed Areas Delineated for the Source Water Assessment

Three nested areas are included in the SWA. These areas are shown in Figure 2.

## **Emergency Response Area**

The Emergency Response Area (ERA) is designed to help the city address potential contaminant sources and, contaminant releases that present an immediate health concern to water users. The ERA highlights point source contamination issues that could impact the water supply. The ERA geographic area is defined by the amount of notification time the city needs to close the surface intake, plus some additional time to accommodate unanticipated delays in notification and shut down.

The Fairmont ERA includes the lakesheds for Budd and Hall Lakes, not including Dutch Creek or the inlet from Amber Lake (Figure 2). The lakesheds were calculated from three-meter LiDAR data available from the DNR, and the results were checked for accuracy during meetings with the city of Fairmont staff and Martin County SWCD. The land in the ERA around the two lakes is mostly developed or used for agriculture.

## **Spill Management Area**

The Spill Management Area (SMA) is designed to focus source water protection activities on potential contaminant sources within 500 feet of either 1) the centerline of a public stream, or 2) the shoreline of a lake contributing flow to the city's source waterbody. Like the ERA, the SMA is designed to highlight point source contamination issues of immediate concern that could impact the water supply.

The Fairmont SMA has been delineated for all tributaries and water bodies that are within 25 river miles upstream of the intake outside of the ERA (Figure 2). All streams reaches for Dutch Creek and the Chain of Lakes are within 25 river miles of the intake, so all connected perennial stream reaches and lakes are within the SMA. All perennial public stream reaches were delineated with buffers of 500 feet width from the centerline of the stream. All lakes within the watershed upstream from Budd and Hall Lakes were delineated with 500 foot buffers from the shoreline.

## **Drinking Water Supply Management Area – Surface Water**

The Drinking Water Supply Management Area – Surface Water (DWSMA-SW) is designed to protect water users from long-term health effects related to low levels of contamination that originate from diffuse, widespread sources. These contaminant sources, known as non-point contaminants, can pose a high-level threat when the combined concentration of the contaminant from across the watershed is substantially high. The DWSMA-SW also delineates areas where future land use development may influence the source water quality. These future development issues are addressed below.

For the city of Fairmont, the DWSMA-SW encompasses the entirety of the watershed area upstream from and including Budd Lake (Figure 2). This area was delineated using HUC 12 watershed boundary data from the U.S. Natural Resources Conservation Service (NRCS). Refinement of the DWSMA-SW was done by using the Minnesota Department of Natural Resources (DNR) surface water auto-catchment dataset to remove those lakesheds that are downstream from Budd Lake. Further refinement was completed around Hall and Budd Lakes using a pour-point analysis of the DNR three-meter LiDAR data within those lakesheds.

The resulting DWSMA-SW includes the lakes upstream from Budd and Hall Lakes: Amber, Mud, Wilmert, and North Silver Lakes, as well as the public streams flowing into those lakes. Those lakes and streams drain from land represented by agricultural, developed, forested, and wetland uses. The DWSMA-SW also includes Dutch Creek, which extends 14.4 miles to the west. The upstream reach of Dutch Creek is a public ditch that has been heavily altered and drains mostly agricultural land. As Dutch Creek gets closer to where it meets Hall Lake, it regains natural stream properties with oxbows and more forested land use. Historical aerial photos from the U.S. Geological Survey (USGS) and the Minnesota Geospatial Information Office (MnGEO) dating back several decades show that the stream and its drainage have not changed much over the past 26 years.

## Source Water Assessment Area

The Source Water Assessment Area (SWAA) includes the entire watershed upstream from the public water supply’s intake. For the city of Fairmont, the SWAA is the same as the DWSMA-SW, as the Chain of Lakes and Dutch Creek are at the very top of the Center Creek sub-watershed of the Blue Earth River watershed. As such, it is not shown in Figure 2 or discussed separately in the rest of this document.

### SWA Area Statistics for the City of Fairmont

Drinking Water Supply Management Area – Surface Water: 19,658 acres

Emergency Response Area: 2,659 acres

Spill Management Area: 4,163 acres

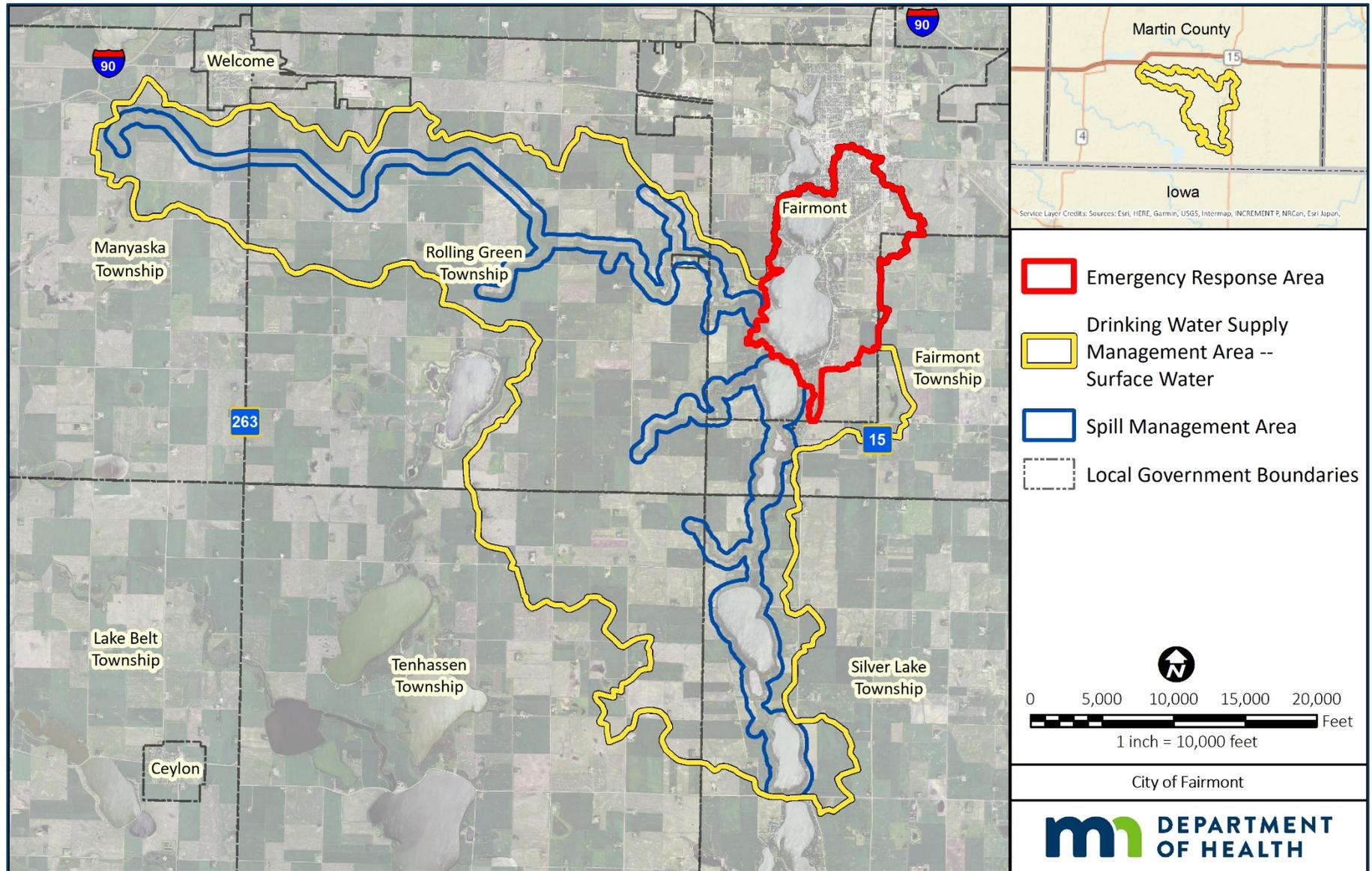


Figure 2 – Fairmont’s Drinking Water Supply Management Area, Spill Management Area, and Emergency Response Area

## Contaminants of Concern

The federal Safe Drinking Water Act (SDWA) regulates primary contaminants, which are listed on the [National Primary Drinking Water Regulations website \(www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations\)](http://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations). They are divided into categories of microorganisms, organic chemicals, inorganic chemicals, radionuclides, disinfectants, and disinfection byproducts.

Water quality indicators are used to determine watershed health. Maintaining source water quality over time ensures that treatment processes remain effective and efficient for consumers. While there may not be drinking water standards or limits for some indicators like total organic carbon or total suspended solids, they can lead to creation of disinfection byproducts (DBPs) within the treatment and distribution systems. DBPs are not usually found in source water, and can be avoided by requiring PWSs that use conventional treatment to remove a significant percentage of total organic carbon prior to chlorination.

In addition to the contaminants regulated by the SDWA, some emerging contaminants are also of concern. Emerging contaminants are chemicals about which we are gaining new understanding and awareness regarding their public health or environmental impacts. These emerging contaminants do not yet have SDWA regulated maximum contaminant levels (MCLs), but may have health-based guidance values developed by the U.S. Environmental Protection Agency (EPA) or MDH. Emerging contaminants of concern for Fairmont include harmful algal bloom toxins. These toxins can be generated by cyanobacteria in lakes and rivers when there is high nutrient concentration.

Table 1 summarizes important water quality detection data for the city of Fairmont. The detections are either concentrations of raw source water sampled from the intake (i.e. turbidity, total organic carbon, E. coli) or from post-treatment entry or distribution point samples (i.e. organic compounds, nitrate, disinfection by-products and harmful algal bloom toxins). Table 1 below highlights the:

- Drinking water quality information for Fairmont
- Violations and significant detections of contamination in the raw (untreated) or finished (treated) water
- Potential or probable sources of the contamination, if the sources are likely from the source water.

Table 1 – Drinking Water Quality Results for the City of Fairmont

Water Quality Parameters and Measurement Units	MCL/Treatment Technique Violations	Detections and water quality concerns	Data Source	Potential Source(s) and comments
Regulated Volatile Organic Compounds, Synthetic Organic Compounds	None <sup>2</sup>	Detections of some herbicides, gasoline compounds with prior treatment plant	MDH-MNDWIS	Entry-point data likely related to source water concentrations
Nitrate (as Nitrogen) mg/L or ppm	2016 Violation <sup>2</sup>	Entry point exceeded 10 mg/L MCL, also raw water in Budd, Hall, and Amber Lakes, and Dutch Creek all above 10 mg/L early May through early July	MDH-MNDWIS, City	High concentrations are probable to recur each spring due to tile drainage and agricultural runoff through watershed
Turbidity (NTU)	None <sup>1</sup>	Source results usually below 10 NTU, which is easily accommodated by current treatment	MDH-MNDWIS	Source water turbidity usually due to erosion in watershed, and can affect treatment process effectiveness
Total Organic Carbon (ppm)	N/A	Treated water usually < 10 mg/l when measured, which is easily accommodated by current treatment	MDH-MNDWIS	Can lead to increased production of disinfection by-products
Disinfection By-Products Haloacetic Acids (ppb)	None <sup>2</sup>	Average total concentration ~13 ppb 2017-2018	MDH-MNDWIS	By-products of chlorine disinfection, needs to be minimized as much as possible
Disinfection By-Products Total trihalomethanes (TTHM, ppb)	None <sup>2</sup>	Average total concentration ~19 ppb 2017-2018	MDH-MNDWIS	By-products of chlorine disinfection, needs to be minimized as much as possible
E. coli (MPN/100 mL)	None <sup>1</sup>	Raw water concentrations usually less than 200 MPN/100 mL, peaks tend to occur in fall	MDH-MNDWIS	Possible sources include sewers, septic systems, sewage lagoons, and animal manure
Harmful Algal Bloom Toxins	N/A	See Table 2	MDH-MNDWIS, City	Indicates presence of potentially harmful algae in water column; not all blooms contain toxins

•1Raw Water

•2Treated Water

•N/A: Not applicable (No MCL exists)

The Minnesota Pollution Control Agency (MPCA) has established that Dutch Creek is impaired by turbidity and fecal coliform for aquatic recreation and life uses. Amber and Hall Lakes are both impaired by nutrients for aquatic recreation purposes. Budd Lake is impaired by nutrients for recreation uses and PCBs for aquatic consumption. Aquatic recreation use, aquatic life use, and aquatic consumption definitions can be found in the [Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305\(b\) Report and 303\(d\) List \(www.pca.state.mn.us/sites/default/files/wq-iw1-04i.pdf\)](http://www.pca.state.mn.us/sites/default/files/wq-iw1-04i.pdf).

While these impairments do not directly pertain to drinking water, they do further underscore the water quality issues observed in the Chain of Lakes. It should be noted that while the city's drinking water treatment system protects against fecal coliform bacteria and can address most of the turbidity issues in the watershed, there are some contaminants that are not as easily treated. Mitigating the aquatic consumption, recreation and life impairments within the watershed would benefit drinking water for the city of Fairmont.

The water quality in the Fairmont Chain of Lakes and Dutch Creek has been impacted by eutrophication. Eutrophication is defined as an excess of nutrients present in the water column of a lake. When eutrophication of a drinking water source occurs it can degrade the overall quality of that drinking water source. The observed eutrophic impacts in the Chain of Lakes that can or have impacted drinking water quality include:

- Increased nitrate concentrations, trending upward since the early 2000s, with the highest concentrations occurring in early spring; and
- Harmful algal bloom (HAB) toxins present during the summer.

## Nitrate

In May 2016 the city's drinking water exceeded MCL for nitrate (10 milligrams per liter nitrate as nitrogen (mg/L)). In response, the city blended raw water from Budd Lake with water from their emergency well to keep the nitrate concentration of their finished water below 10 mg/L until the lake concentration fell below the MCL. Blending occurred from May 17, 2016, through July 24, 2016. Nitrate has since remained below the MCL in both raw and finished water.

The city has increased monitoring, both in the greater watershed and in their raw water intake, since the exceedance. The city adopted a 2016 Nitrate Action Plan that outlines standard operating procedures the city will implement as nitrate increases in Budd Lake. The city has committed to blending raw water from Budd Lake with emergency well water when nitrate levels in Budd Lake reach 8.5 mg/L. This will help ensure that finished drinking water concentrations do not exceed the MCL in the future. A 2019 update to the Nitrate Action Plan has been filed with MDH.

As a result of the MCL exceedance in 2016, MDH partnered with the city of Fairmont to monitor nitrate trends in the city's raw water over the course of a year (MDH, 2018). MDH used a water quality sonde to measure nitrate concentration trends in raw water from March 2017 through August 2018 to better understand when nitrate levels were the highest in Budd Lake.

Sonde water quality results, which are shown with grab sample results in Figure 3, showed that nitrate was the highest during the spring from April through mid-June 2017. This is likely because thawing soils were releasing nutrient-rich water through drain tile into streams and lakes that feed into Hall and Budd Lakes. The nitrate concentrations remained high until water temperatures in the lakes were high enough to support photosynthesis, which then consumed the nitrate. At that point, nitrate concentrations fell. Concentrations continued to fall throughout the summer, with some brief deviations during and immediately after storm events.

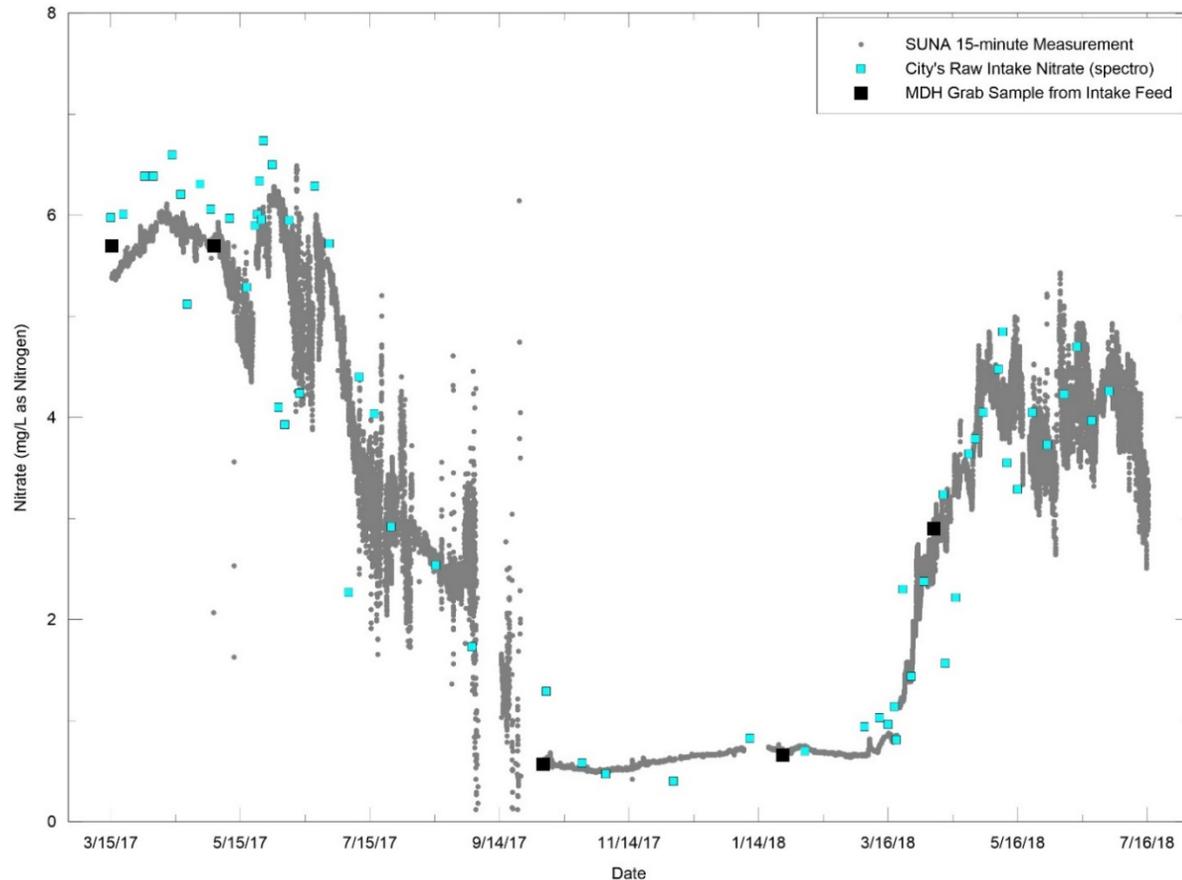


Figure 3 – Nitrate concentration measurements over time, as collected by MDH nitrate measuring sonde.

The lowest concentrations were found throughout the fall and winter months of 2017-18. Similar trends are likely to recur every year in the Chain of Lakes, with some differences due to precipitation events and overall nitrate loads in thawing soils in the watershed.

One important feature of the study dataset is the timing of the early spring concentration spike. Most watershed monitoring traditionally does not begin before the end of April, which can miss large and potentially important fluctuations in nitrate concentration that occur with surges in snowmelt. The raw data show that there were some variations in March and early April in both 2017 and 2018 that would have been missed in traditional grab sampling. This dataset roughly corresponds with the 2016 observations of nitrate concentration, which occurred during the period of groundwater blending.

Most nitrate data for Dutch Creek and the Chain of Lakes show an upward trend over time. Recurring MPCA monitoring in the watershed since 2000 indicates an upward trend in nitrate in Dutch Creek (Figure 4). Figure 4 shows all Dutch Creek nitrate data plotted against time. The data consistently point to an upward trend in nitrate levels. Linear analysis of the data indicate that nitrate increased at a steady rate of approximately 0.3 mg/L per year since 2000.

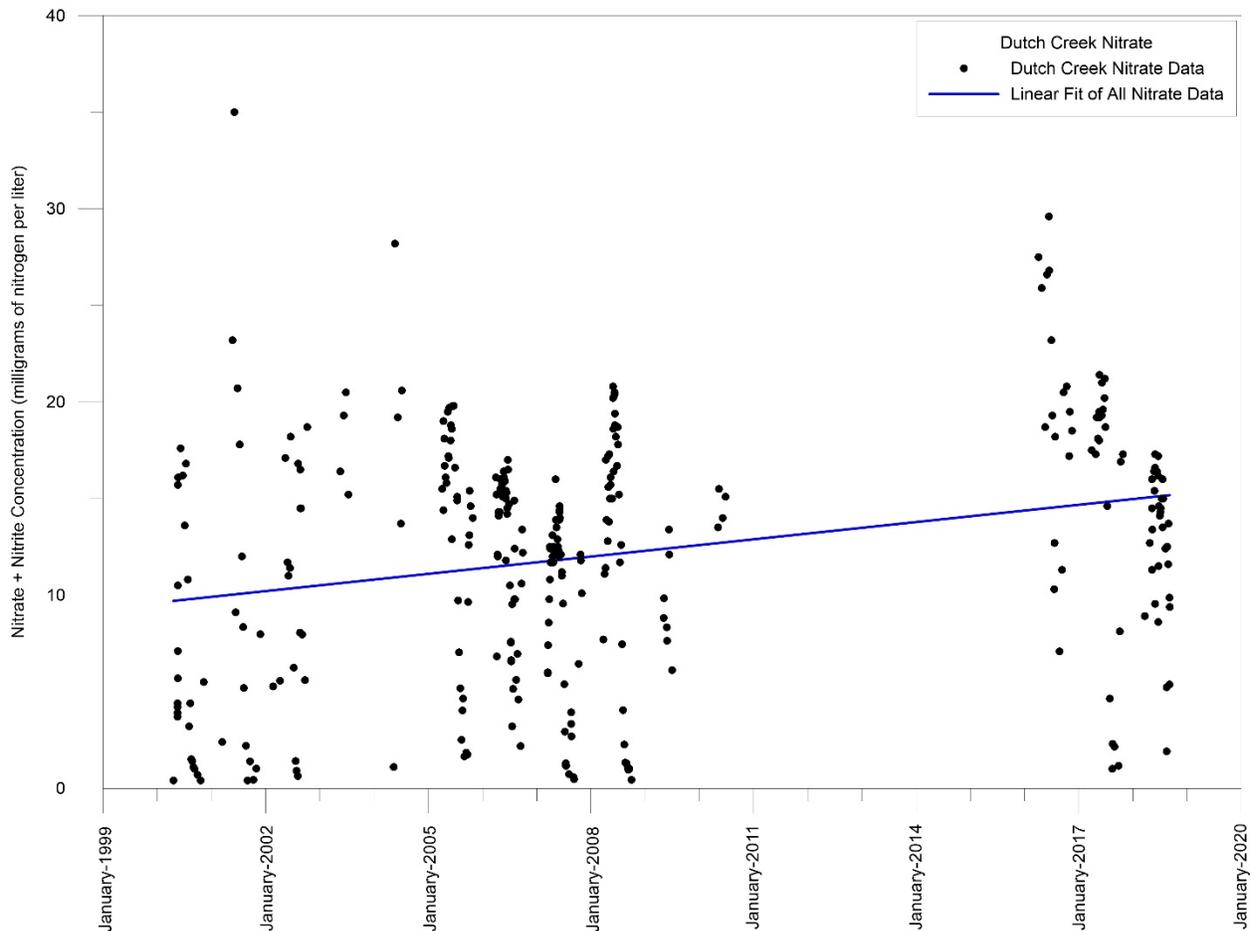


Figure 4 – Nitrate concentration data and calculated linear trends of data for Dutch Creek from 2000 through 2018. 2018 data is preliminary and subject to change.

Figure 5 shows the average annual nitrate concentration over time for some of the Chain of Lakes. Average nitrate concentrations increased in Hall, Budd, and Sisseton Lakes since 1988, with large increases occurring between 2001 and 2017. Average nitrate concentrations were consistently the highest in Hall Lake, which is the receiving water for both Amber Lake and Dutch Creek. Also shown are the maximum and minimum observed concentrations for each year.

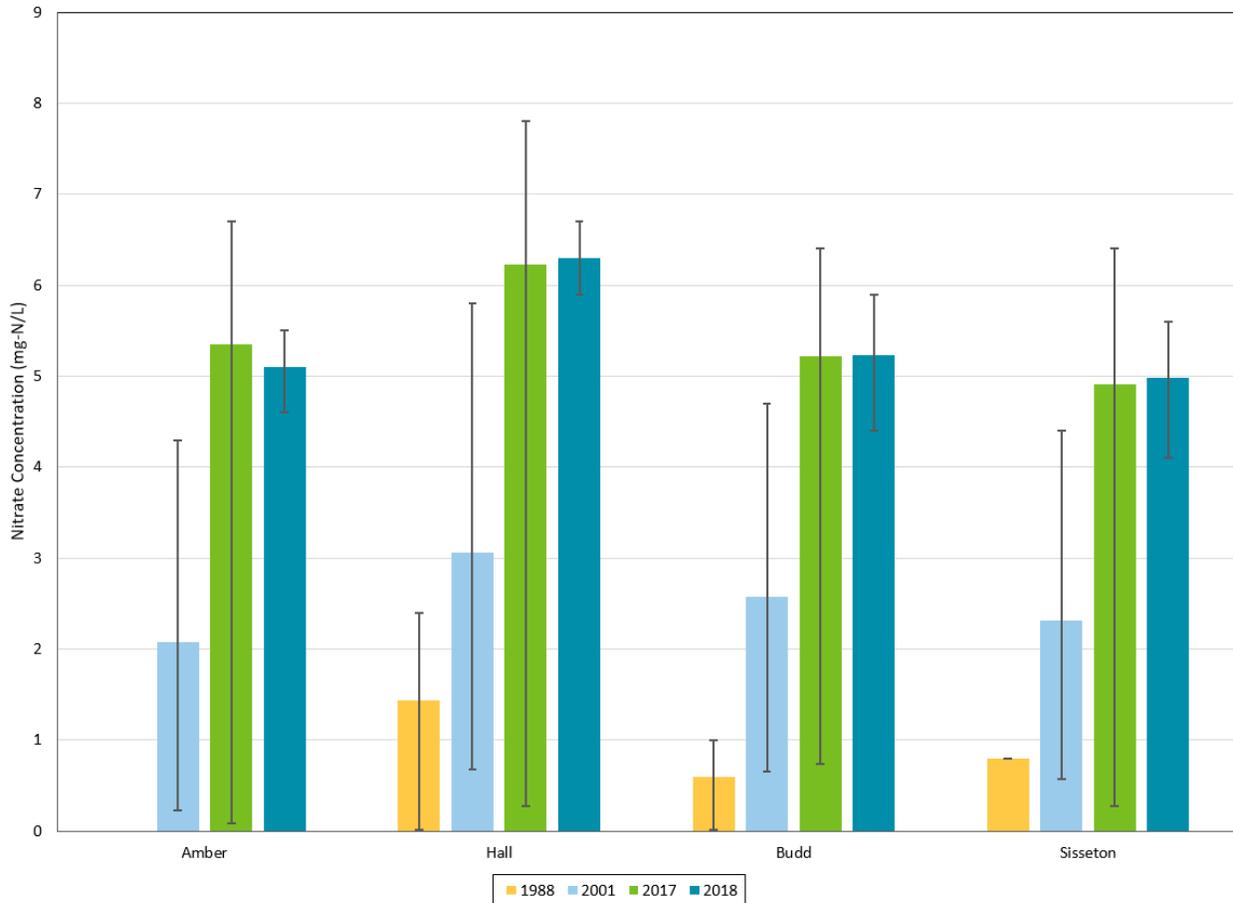


Figure 5 – Average nitrate concentrations for MPCA monitored lakes in the Fairmont Chain of Lakes. Whisker lines represent the maximum (upper) and minimum (lower) observed nitrate concentrations for each year.

## Harmful Algal Blooms and Associated Toxins

Harmful algal bloom (HAB) toxins have also been detected in Fairmont’s raw water, as shown in Table 2. HAB toxins are generated by photosynthetic bacteria, known as cyanobacteria that occur naturally in water. During blooms, cyanobacteria become visible as dense green areas in the water and can cover large expanses of a water body. These blooms can contain the bacteria that create HAB toxins, although not all blooms are accompanied by HAB toxins. However, when toxins are present they can cause illness in people and pets exposed to them, either through skin contact, breathing in water droplets, or drinking the water. HAB toxins, of which microcystin is the most commonly found in Minnesota, do not have MCLs; however, some individual toxins do have MDH health-based guidance values. The city of Fairmont has taken steps to address these contaminants by installing granular activated carbon (GAC) filters in the water treatment facility constructed in 2013. More information on these toxins and their possible health impacts can be found on the [MDH Harmful Algal Blooms \(HABs\) webpage \(www.health.state.mn.us/diseases/hab/index.html\)](http://www.health.state.mn.us/diseases/hab/index.html).

Table 2 – Historical Microcystin Sample Results

Sample Date	Raw Water Concentration (ug/L)	Finished Water Concentration (ug/L)	Data Source
9/4/2012	0.83	< 0.15 <sup>1</sup>	MNDWIS
10/1/2012	0.54	< 0.15 <sup>1</sup>	MNDWIS
9/12/2016	0.67	< 0.15 <sup>1</sup>	City of Fairmont
9/6/2018	0.22	< 0.15 <sup>1</sup>	City of Fairmont

<sup>1</sup>Reporting limit for analysis was 0.15 ug/L. Officially reported as non-detect in lab documentation.

## Potential Contaminant Source Inventory

MDH and the city of Fairmont conducted a Potential Contaminant Source Inventory (PCSI) to evaluate the different types of contaminants found in the watershed that threaten the quality of the city's source water. These identified potential sources can have a direct or indirect threat to public health and the drinking water quality. The PCSI is organized by threats and potential risks closest to the intake (i.e. ERA), potential contaminants along contributing water bodies (i.e. SMA), and land use management within the DWSMA-SW. The data in the tables was collected from various state and local databases and discussed in detail with the city and SWCD.

An interactive map was created for the PCSI and a Keyhole Markup Language (i.e. KML) file version of the map will be provided to the city of Fairmont and Martin County SWCD for spatial reference. MDH can provide an archived map and its attributes for these locations to other partners on request.

The following source summaries document the different types of contaminant sources within the ERA and SMA. Certain types of contaminants are indicated as being high priority due to the fact that they can have a significant impact on surface water quality. Each identified contaminant source went through a detailed analysis; MDH can provide the criteria for these analyses on request.

## Emergency Response Area

### Point Sources

The following summary documents the point sources identified in the ERA:

<b>Point Sources in the ERA</b>	
Budd Lake Stormwater Outlets:	12 (high priority)
Construction Stormwater Permit:	6
Chemigation Permit:	1
Other Stormwater Outlets:	86

The six construction stormwater permits are considered open and active. The runoff from these sites can contaminate the city’s source water if not handled appropriately. A simple on-site visit to these locations can determine if they are a potential contamination source.

Janzens Greenhouse has an active chemigation permit. They have storage units on-site and conduct applications of agricultural chemicals such as fertilizers and/or pesticides, including herbicides, insecticides, bactericides, nematicides, algaecides, miticides, and fungicides.

The stormwater outlets are a concern for the city of Fairmont. There are 86 total stormwater outlets, 12 of which flow into Budd Lake. Eleven of those outlets drain 2.1 linear miles of stormwater pipe. There is one outlet that drains 11.7 linear miles of stormwater pipe, and this stormwater outlet should be a priority for the city of Fairmont. These storm water and drain tile outlets have the ability to quickly carry many different types of contaminants directly to waterbodies draining to Budd Lake and can degrade the drinking water source quality.

### Non-Point Sources

The following summarizes the non-point sources identified in the ERA:

<b>Non-Point Sources in the ERA</b>	
Boat Landings:	2 (high priority)
Fishing Pier:	1 (high priority)
Road/Bridge Over Surface Water:	1 (high priority)
Open Green Spaces (Baseball Fields, Parks, etc.):	5
Cemetery:	1

Any type of conveyance that can quickly carry contaminants to waterbodies should be considered a high priority. Two types of conveyances in the Fairmont area are roadways and impervious surfaces. Inside the ERA, there are 36.1 miles of roadways and one bridge, West Lair Road, that crosses over the channel from Hall Lake to Budd Lake. West Lair Road is the main concern for a potential contaminant spill. The remaining roads are mostly residential and do not pose as high of a risk to the surface water. Additionally, there are two boat landings (Budd and Hall Lake) that can quickly carry contaminants to the source water.

The fishing pier and green space that were installed on Budd Lake in 2015 could pose major concerns for point and non-point contamination. This is a public access space with a steep gradient down to Budd Lake. It could funnel nutrients or other contaminants toward the lake. It can also be accessed by anyone and should be a focus of security to protect Budd Lake.

Large green spaces such as parks, golf courses, and outdoor recreational sport spaces can be a significant source of nutrient runoff and contamination, depending on how they are managed. Fairmont High School, Fairmont Elementary School, Fairmont Dog Park, Gromsrud Park, Calvary Cemetery and Fairmont Aquatic Park have large green spaces that could also be a source of nutrient runoff.

The Fairmont Dog Park is a historical area that was used to deposit silt dredge material from Budd Lake. This is one of four deposit site locations, but this is the only one inside the ERA. Originally the dog park was part of Luedtke Slough, until it was filled in with the silt dredge material. This site was part of an Environmental Protection Agency (EPA) investigation to test the soil to evaluate the threat to human health and environment. The results showed that the soil does not impose a human health or environmental risk. MDH can provide the final EPA report on request (EPA Report).

## Spill Management Area

### Point Sources

The following summary documents the point sources identified in the SMA:

<b>Point Sources in the SMA</b>	
Aboveground Tank:	1 (high priority)
Feedlots:	5 (high priority)
Stormwater Outlets:	16 (high priority)

The only aboveground tank in the SMA is located at the Interlaken Golf Club. It is a gasoline tank that can hold up to 1000 gallons. The golf course is located on the east side of Amber Lake.

The five feedlots in the SMA are a source water protection priority because of their proximity to surface water.

There are 16 stormwater outlets surrounding Amber Lake, which have the potential to impact the ERA due to Amber Lake’s connection with Hall Lake.

### Non-Point Sources

The following summarizes the non-point sources identified in the SMA:

<b>Non-Point Sources in the SMA</b>	
Boat Landings:	3 (high priority)
Roads That Impact Amber Lake:	2 (high priority)
Roads/Bridges Over Surface Water:	17
Golf Course:	1
Holding Ponds:	3
Open Green Spaces (Baseball Fields, Parks, etc.):	2

The boat loadings on Amber Lake and Wilmert Lake can provide easy and quick access for contaminants into the waterbodies. Flow from runoff or spills nearby would be funneled into the boat landing and then into the lakes.

Any type of conveyance that can quickly carry contaminants to waterbodies should be considered a high priority. There are 19 roads that cross over a stream or lake in the SMA; the main bridge crossings are Lake Aries Road and Interlaken Road, which are on the north and south side of Amber Lake, respectively. These two road crossings are a main point of entry and should be considered a high priority for protection or maintenance activities. The remaining crossings are less of a priority due to the decreased impact that a spill would have on the downstream drinking water source. The time of travel and dilution factor are much higher on the remaining 17 roads.

As mentioned above, large green spaces can be a source of nutrient runoff and contamination. Interlaken Golf Club is located immediately east of Amber Lake, which is above gradient of Budd Lake. Cedar Park and Amber Lake Park are also open spaces that could be sources of nutrient runoff.

There are three large ponds approximately one mile west of Hall Lake that, historically, were used as discharge ponds for lime sludge. These ponds now hold surface water runoff, which can be discharged directly to Dutch Creek. The Fairmont Water Treatment Facility has an ongoing permit through the Minnesota Pollution Control Agency (MPCA) that allows Fairmont to discharge water from those ponds to Dutch Creek. The discharge permit has set limits on:

- pH
- Phosphorus
- Total Residual Chlorine
- Total Suspended Solids

Reports for the ponds are supplied to the MPCA on a quarterly basis. Discharge is only necessary when the levels of the ponds present an overflow issue. This is usually due to increased precipitation in the area. A closure plan for these ponds has received preliminary MPCA approval with closure to be accomplished within five years.

## **Drinking Water Supply Management Area – Surface Water**

Point source contaminants are not considered for management within the DWSMA-SW by definition. Non-point source management through analysis of land use, existence of drain tile, and nutrient and pesticide sourcing within the DWSMA-SW is addressed below.

## Land Use

Land use plays an important role in water quality and directing implementation activities in the ERA, SMA and DWSMA-SW. The following section describes land uses found in these areas and associated impacts to surface water quality and drinking water. The area is mostly made up of three major types of land use: cultivated crops, open water, and development.

### **Emergency Response Area**

The majority of the ERA is in the city limits of Fairmont and is dominated by development and open water land uses. Development is almost half (46.9%) of the land use area in the ERA. The two major waterbodies, Budd Lake and Hall Lake, make up 30.1% of the ERA.

### **Spill Management Area**

The SMA is comprised of cultivated crops and open water land uses. There is one main stream (Dutch Creek) and a series of lakes and other streams that contribute to Hall Lake. Dutch Creek is located on the western portion of the DWSMA-SW and is made up of 21 stream segments. It flows approximately 22 miles through land that is heavily dominated by cultivated crops land use before exiting into Hall Lake. The southern portion of the DWSMA-SW contains a series of five lakes and five stream segments. Overall, surface water travels through approximately 1,040 acres of lake basins and 4.5 miles of streams in an area that is dominated by cultivated crop and wetlands before exiting into Hall Lake.

The Minnesota buffer law was established in November 2017 for all public waters and November 2018 for public ditches. The law provides flexibility to all landowners to comply with the law by using practices that are outlined in the Natural Resources Conservation Service Field Office Technical Guide. Martin County is unique in that 95-100% of its stream reaches are compliant with the buffer law, compared to the surrounding counties, which are less than 70% compliant. Buffered waterbodies that are in compliance are low priority for Source Water Assessment and planning purposes.

Public waters and ditches that are not in compliance should be considered high priority. Protecting waters that contribute to the drinking water supply should be addressed first. Implementation activities will require collaboration and communication with Martin County. Compliance with the buffer law is beneficial for managing surface water runoff near waterbodies, but with 56 miles of drain tile in the DWSMA-SW, the management of land use and fertilizer practices needs to be addressed as well.

## Drinking Water Supply Management Area – Surface Water

The DWSMA-SW is Fairmont’s largest delineated protection area at 26,372 acres. Over 75% of the land use is cultivated crops. The second largest land use component is development (10.5%) and is comprised of impervious surfaces such as roads, buildings, and other infrastructure.

Given the large percentage of cultivated crops, drain tile (56 miles), and continued Martin County SWCD promotion of cover crops in the DWSMA-SW, this area would benefit from better nitrogen and drainage management to help reduce the overall loading effects.

The following table describes land uses within the ERA, SMA, DWSMA-SW, and the Blue Earth River HUC 8 Watershed.

Table 3 – Land Uses within Delineated Protection and Watershed Areas

Type of Area (unit size)	Emergency Response Area	Spill Management Area	Drinking Water Source Management Area – Surface Water	Larger Watershed Area (Blue Earth River HUC 8)
Protection Area (acres)	2,654	4,163	26,372 <sup>3</sup>	777,701
Lake area in acres (# of lakes)	802 (3 Lakes)	843 (6 Lakes)	1,642 (9 Lakes)	12,689 (97 Lakes)
Stream length in miles (# of stream segments <sup>2</sup> )	.27 (3 Stream segments)	27.9 (29 Stream segments <sup>1</sup> )	28.2 (32 Stream segments <sup>1</sup> )	720 (126 Stream segments)
Open Water (acres)	802 (30.1%)	843 (20.3%)	1,653 (6.3%)	14,014 (1.8%)
Development (acres)	1,248 (46.9%)	242 (5.8%)	2,757 (10.5%)	56,461 (7.3%)
Barren Land (acres)	0 (0%)	0 (0%)	4 (<1%)	645 (0.1%)
Forest (acres)	2 (0.1%)	28 (0.7%)	99 (0.4%)	7,879 (1.0%)
Shrub land (acres)	35 (1.3%)	463 (11.1%)	950 (3.6%)	16,800 (2.2%)
Hay/Pasture (acres)	0 (0%)	124 (3.0%)	170 (0.6%)	5,860 (0.8%)
Cultivated Crops (acres)	504 (18.9%)	2,041 (49%)	20,079 (76.1%)	650,548 (83.7%)
Wetlands (acres)	69 (2.6%)	421 (10.1%)	661 (2.5%)	25,495 (3.3%)

<sup>1</sup>Stream were determined by historical photo analysis showing perennial flow

<sup>2</sup>Streams are based on the National Hydrography Dataset (NHD) flowlines

<sup>3</sup>Area is a combined acreage of the ERA, SMA, and DWSMA-SW

# Summary of High-Priority Issues

The issues below are the highest priority for action within the delineated Source Water Assessment areas for the city of Fairmont.

The city's source water has been impacted by eutrophication. Nitrate concentration has been trending upwards since the early 2000s due to agricultural practices in the watershed. The highest nitrate concentrations observed tend to be in the late spring to early summer, before algal and bacterial productivity in the Chain of Lakes begins removing nitrate in the water column. In turn, algal and bacterial productivity increases HAB toxin production. These toxins can cause illness in people and pets exposed to them, and are a potential safe drinking water threat.

**Emergency Response Area:** The city should address the management and emergency plans for spills to mitigate any contamination events. The main concerns in the ERA are the 12 stormwater outlets that surround Budd Lake. West Lair Road is of concern as a conveyance that crosses the stream segment that connects Hall and Budd Lakes. Any spills or releases that drain into the stormwater system connected to those 12 outlets, or on West Lair Road, could have an immediate impact to the main drinking water source for the city of Fairmont. Park Motor Company's aboveground tanks can potentially spill into the stormwater system and drain to Budd Lake.

The boat landings on Budd and Hall Lake, the fishing pier near the Fairmont public water supply treatment plant, and West Lair Road could all have an immediate impact of the source water because they could allow contamination to enter the water.

**Spill Management Area:** The primary concerns in the SMA are the 16 stormwater outlets that surround Amber Lake and two road crossings: Lake Aries Road and Interlaken Road. Additional concerns include: the boat landings at Amber and Wilmert Lakes; and Interlake Golf Club, which has an aboveground tank. These sources, along with the five feedlots inside the SMA, have the potential to contaminate the source water.

**Drinking Water Supply Management Area – Surface Water:** The DWSMA-SW is heavily dominated by agriculture. The long-term health of the watershed can be improved by focusing on best management practices for land use, fertilizer, and runoff, all of which can have negative impacts on water quality. Managing fertilizer and runoff issues should help mitigate harmful algal bloom risks, as well.

## Recommended Actions

The SWA is a tool for the PWS and local partners. The PWS and local partners should consider implementing the activities below to protect the source water and its surrounding watershed. The activities should also be included in the city of Fairmont's Surface Water Intake Protection Plan.

### **Monitoring Source Water**

Continued monitoring of source water quality is needed to determine the best implementation approaches to address the poor water quality in the contributing watershed. Dutch Creek, Amber Lake, and their contributing waterbodies should be the main focus of implementation. As was mentioned in the "Contaminants of Concern" section, Dutch Creek and Amber, Hall, and Budd Lakes are impaired for aquatic recreation and aquatic life.

Watershed flow modeling of the Chain of Lakes and Dutch Creek would help refine the delineation of the SWA areas identified in this document. Creating a valid model requires large amounts of flow data. Once established, the model can be used to determine potential impacts from contaminant sources throughout the watershed. A model could also help to better outline nutrient budgeting in the watershed.

### **Emergency Preparedness**

Emergency spill prevention and response preparedness is a vital aspect of protecting the source water. Establishing a PWS emergency plan is necessary and should be completed and coordinated with the MPCA Emergency Response unit, first responders, city planners, and local government staff.

### **Potential Contaminant Source Management**

Point and non-point source nitrate contamination is a high priority for protecting source waters and public health. The point source locations of highest concern are listed in the Potential Contaminant Source Inventory section. Each one of the PCSI points is associated with an agency (MPCA, MDA, etc.), local authority, or contaminant source owner. These entities should work together to set up an approach to mitigate the contaminant issue.

### **Contaminant Conveyances and Potential Releases**

Stormwater and stormwater outlets in the ERA are a major concern for the public water supplier. The outlets that surround Budd Lake are of even greater concern, as they are directly connected to the main source of drinking water. Understanding the directional flow and contributing surfaces to the stormwater system is key to understanding how to mitigate any

potential contamination. The current MS4 general permit for the city of Fairmont through the MPCA does not identify the Chain of lakes as a drinking water source. MDH recommends that when the permit is amended, the appropriate waterbody classifications are identified for each of the outlets that contribute to them.

## **Non-Point Source Pollution and Land Management**

Non-point source nitrate is the contaminant of highest concern for the Fairmont public water supply. Nitrate should continue to be addressed in cooperation with watershed authorities, local producers, and agronomists. Education of these groups about drain tile and nutrient runoff should be key components of the plan.

Harmful algal blooms in the Chain of Lakes are of concern due to their potentially harmful public health effects, and are caused by nutrient loading within the watershed. The city has a monitoring plan for cyanotoxins, but the monitoring may miss peak toxin concentrations, because maximum toxin concentrations in the water column generally occur days or weeks before a bloom is observed visually. An expanded monitoring plan that begins in early spring could help identify when the water supply is most at risk for cyanotoxins each year. Educating residents and farmers on algal bloom causes, occurrence, and impacts should also be considered.

## **Alternative Water Supply**

Alternative and emergency water sources are an important factor in source water protection planning. Alternative water sources such as groundwater have been discussed and studied in conjunction with the DNR. The decision was made in 2010 to build the new public water supply treatment facility and continue to use surface water as the primary drinking water source. The DNR has expressed concerns about available surface water quantity in the Chain of Lakes, particularly during drought conditions, and the DNR has conducted groundwater feasibility studies for the city's Appropriations Permits (DNR, 2003). The city has amended its groundwater appropriation to be better prepared for a situation that would require blending or even the possibility of exclusive use of its groundwater source for limited periods.

The "System Characteristics" summary above states that the city of Fairmont has storage capacity for about five days of water supply, based on existing storage capacity. Events outside of that window would require the use of the emergency well. The emergency well is not intended to be a full-capacity back-up source, although it can be blended with surface water. It costs the city of Fairmont an additional \$1,500 per day in operational treatment costs when blending at 35 percent groundwater from the emergency well with 65 percent from Budd Lake. Blending lake water with more than 50 percent well water would cause chemical issues within the city's current treatment and distribution systems. Exploring for and possibly establishing a full-capacity back-up source of drinking water and upgrading treatment technologies to accommodate blending concerns should be considered to address appropriations concerns and ensure that Fairmont's water supply is more resilient during times of reduced surface water quality and quantity.

## Surface Water Intake Protection Planning

MDH can assist the city in developing a Surface Water Intake Protection Plan (SWIPP) that will lay out strategies for protecting and improving source water quality. The city of Fairmont can receive assistance from the MDH Surface Water Planner and Hydrologist to complete the planning document. Upon completion of the SWIPP, the city of Fairmont can be eligible for MDH plan implementation grants to fund documented plan activities. The SWIPP will also guide the PWS and local planning partners by documenting other potential complementary watershed-level activities to protect drinking water on a larger scale than can be accomplished by the PWS alone. Examples of this include the Martin County local water plan (2017-2026), which has identified surface water quality and quantity for drinking water as a priority one concern, and could benefit from prescribed actions documented in the SWIPP. Additionally, the implementation strategies developed in the SWIPP can be used to inform drinking water-focused activities in the Blue Earth River One Watershed One Plan when it is written.

The SWA is designed to be a guidance for planning purposes for the next 10 years. After the 10 years have elapsed MDH will reassess the PWS source water area. This updated SWA will guide the amended SWIPP.

## References

Frischman, J.R. (2013), City of Fairmont, Groundwater Appropriations Permit 1978-4300, Martin County, Memorandum, Minnesota Department of Natural Resources, St. Paul, Minn., 6 p.

Lund, T.J. (2018), *Fairmont Nitrate Monitoring Study*, Minnesota Department of Health, St. Paul, Minn., 8 p.

Oneida Total Integrated Enterprises. (2013), *Site Investigation Report, Fairmont Lakes City of Fairmont, Martin County, Minnesota*, Prepared for US EPA TDD No.: TO-02-12-03-1001, Chicago, IL, 111 p.

Tetra Tech. (2018), *Dutch Creek and Hall Lake SWAT Modeling Report*, St. Paul, Minn, 89 p.

United States Environmental Protection Agency. [National Safe Drinking Water Act Contaminants National Primary Drinking Water Regulations. www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations.](http://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations)