

TOWN OF WINNETT PUBLIC WATER SYSTEM

PWS ID No. MT0000364

DRAFT SOURCE WATER DELINEATION & ASSESSMENT REPORT

PREPARED BY:

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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared under the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is completing these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the inventory region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

Winnett's drinking water is supplied by two wells, located at the eastern edge of town. In accordance with the Montana Source Water Protection Program criteria (1999), the aquifer (source water) is considered to have a low sensitivity to potential contaminant sources since it is comprised of consolidated sandstone bedrock. In addition, the aquifer is confined. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

As part of this assessment, three types of source water protection management areas were mapped for the Winnett public water system. They are: the control zone, the inventory region, and the recharge region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- No potential sources of contamination were identified within the control zone. The goal of management in the control zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. The control zone is delineated as a 100-foot radius around the wellhead. All sources of potential contaminants should be excluded from the control zones.
- Significant potential contaminant sources identified within the inventory region are limited to agricultural land and an abandoned railroad.

The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region includes the area that is expected to supply groundwater recharge to the well over the next three years. Due to the depth to the Winnett PWS well intakes, this is delineated as a 1,000-foot fixed radius.

- Potential contaminant sources identified within the recharge region are limited to agricultural land.

The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage.

The Winnett public water supply has a very low susceptibility to the surrounding agricultural land. Nitrate has not been detected in the Winnett PWS water within the past five years, nor have coliform bacteria.

Low risk potential sources and potential sources located outside the inventory region, but within the recharge region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for the Winnett. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high, and prevention is preferable to treatment. Public awareness is a powerful tool for protecting drinking water. The information in this report will help increase public awareness about the relationship between land use activities and drinking water quality.

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1.0 INTRODUCTION

Eric Sivers, a hydrogeologist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Section, completed the Winnett (PWS ID No. 0000203) Source Water Delineation and Assessment Report (SWDAR). Bill O'Connell of Montana Rural Water Systems, Inc. provided additional information regarding the town's water system.

The primary purpose of this source water delineation and assessment report is to provide information that helps Winnett protect its drinking water source. The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. The major components of the Montana Source Water Protection Program are *delineation* and *assessment*. Delineation is the process of mapping source water protection areas, which contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources.

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for the completion of the delineation and assessment for the Winnett Public Water System (PWS) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

2.0 BACKGROUND

Winnett is located in Petroleum County in central Montana ([Figure 1](#)), approximately 45 miles north-northeast of Roundup, and 54 miles east of Lewistown. According to the Census Bureau, the population of Petroleum County in 2000 was 493, with 185 individuals residing in Winnett

2.1 PHYSICAL SETTING

2.1.1 Geography and Geology

Winnett is located on the unglaciated plains of central Montana, at an elevation of approximately 2,900 feet above mean sea level. Winnett's public water supply is located on the eastern edge of the town, and draws water from two deep (2,000+ feet) wells.

The area is characterized by relatively flat-lying sedimentary rocks of Cretaceous age, slightly incised by alluvial valleys. Alluvial deposits are localized in these valleys. Selected geology of the Winnett area is shown on [Figure 2](#), with emphasis given to the Jurassic rocks that the Winnett PWS taps for its water. These rocks are deeply buried beneath Winnett, but are uplifted and exposed on the flanks of the Big Snowy Mountains to the west.

Winnett is located in the Western Glaciated Plains groundwater region of North America (Heath, 1984). The community is in the Box Elder Watershed (10040204), in the Lower Missouri River drainage of Montana ([Figure 1](#)).

2.1.2 Climate

Climate in the Winnett area is semi-arid and typical of central Montana. Annual total precipitation is 12.64 inches. Rainfall occurs April through September with May and June being the wettest months. Winnett receives an annual average of 46.7 inches of snow, mainly December to April. Climate data was recorded by the Winnett 5 NNE climate station,

covering the period between July 1948 and October 1971. This data was provided by the Western Regional Climate Center, operated by the Desert Research Institute of Reno, Nevada. See Table 1 for additional climate information.

Table 1. Monthly Climate Summary: Winnett 5 NNE Climate Station (249047)

Period of Record: 07/01/1948 to 10/31/1971

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Ave. Max. Temp (F)	Insufficient Data												
Ave. Min. Temp. (F)	Insufficient Data												
Ave Tot. Precip. (in.)	0.66	0.42	0.48	1.15	2.23	2.42	1.63	1.12	0.99	0.68	0.41	0.46	12.64
Ave. Tot. Snowfall (in.)	10.8	6.4	6.9	7.6	1.4	0.3	0.0	0.0	0.2	2.9	3.2	7.0	46.7
Ave Snow Depth (in.)	4	4	2	0	0	0	0	0	0	0	0	2	1

2.2 THE PUBLIC WATER SUPPLY

2.2.1 Water Supply System

The Winnett PWS serves approximately 188 people through 128 service connections. The Winnett PWS is classified as a community public water system since it serves at least 25 of the same people every day. Information on the water system was obtained from correspondence in the DEQ Public Water Supply Section files, including the most recent sanitary survey, completed in 2000 (attached as Appendix A). Groundwater is provided by two wells. A storage tank provides a 252,000-gallon reserve.

2.2.2 Supply Well Information

Winnett's drinking water is supplied by two wells located on the eastern edge of town. The supply wells (New SW Well #2 and Well 3) are completed to depths of 2,153 feet and 2,151 feet, respectively. According to the well logs, the wells are completed in the Jurassic Morrison Formation. The well casing is constructed of 12"-diameter steel, and the slotted interval is 8"-diameter steel. According to the logs, the wells yield 75 and 24 gallons per minute (gpm). The wells were completed in 1972 and 1983. The well logs are attached as Appendix A.

2.2.3 Source Water

The Winnett PWS wells are completed in the Morrison Formation. This aquifer is most likely recharged by infiltration of precipitation and surface water in outcrops exposed where the Morrison Formation is uplifted in the Big Snowy and Judith Mountains.

According to the Source Water Protection Program (DEQ, 1999) the source water aquifer is considered to have low sensitivity to potential contamination, since it is consolidated sandstone bedrock and confined.

Based on the results of a groundwater under the direct influence of surface water (GWUDISW) study completed in 2002, the source water is classified as groundwater.

2.3 WATER QUALITY

Each PWS is required to perform regular sampling of their water supply to detect contamination. The analytical parameters include: coliform bacteria and other pathogenic organisms, nitrates, metals, petroleum hydrocarbons, and other organic chemicals. The monitoring schedule depends on factors such as the size and source water of a PWS, the number of supplies (e.g. wells), and the population served. Monitoring programs are tailored to each system, following the general protocols defined by DEQ. Monitoring schedules are available at: <<http://nris.state.mt.us/wis/swap/swapquery.asp>>. The Winnett PWS monitoring data from DEQ's database for the past five years was reviewed and is summarized in this section. Analytical results are compared to quality standards established by the US EPA. Maximum Contaminant Levels (MCLs) are enforceable standards that limit the highest level of a contaminant allowed in drinking water. National Secondary Drinking Water Standards (known as SMCLs) are non-enforceable guidelines regarding contaminants that may cause aesthetic (color, odor, taste) or cosmetic (staining, skin/tooth discoloration) issues.

2.3.1 Public Water Supply Monitoring Results

Coliform bacteria have not been detected during the past five years. No regulated contaminants have been detected over the method detection limit (MDL). Dichloromethane, a chlorination byproduct, was detected at 0.0015 mg/L (milligrams per liter, or parts per million), below the MCL of 0.005 mg/L. Radiologicals (gross alpha and Radium 226-228, combined) were both detected in 2003, but at concentrations below the MCL.

Fluoride has been detected at concentrations of 3.041 mg/L and 2.64 mg/L, above the SMCL of 2.0 mg/L. Sulfate has been detected at 321 mg/L, above the SMCL of 250 mg/L. The water quality results are attached as Appendix B.

2.3.2 Background Water Quality Monitoring Results

No background water quality data was identified for the Winnett supply wells. Background water quality sampling typically includes general water quality parameters including major dissolved ions (calcium, magnesium, sodium, potassium, iron, manganese, silica, bicarbonate, carbonate, chloride, sulfate, nitrate, fluoride and orthophosphate), trace elements, and metals.

3.0 MANAGEMENT AREA DELINEATION

This report delineates three source water management areas. The goal of source water management is protection of the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the inventory region, and 3) ensuring that major land use activities or other significant activities in the recharge region pose minimal threat to the source water.

3.1 CONCEPTUAL MODEL

Winnett's source water is located in the Box Elder watershed (USGS Hydrologic Unit Code 10040204), which is located within Montana's Lower Missouri River watershed. As detailed above, Winnett's drinking water source is interpreted to originate as rain/snowfall and runoff in the Big Snowy and Judith Mountains. The direction of groundwater flow cannot be accurately determined within the scale of this report, but likely includes both easterly and northerly components. The aquifer is considered confined, based upon the lithologies reported in the well log and the reported artesian conditions.

3.2 DELINEATION

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). The delineated management zones for the wells are shown on [Figure 3](#).

Control Zone – A 100-foot radius control zone is delineated for the well. All sources of potential contaminants should be excluded in these regions.

Inventory Region – The inventory region is the area that is expected to contribute to the water supply within no less than three years. All significant sources of potential contaminants are inventoried in this region. According to the DEQ's Source Water Protection Program criteria for a confined aquifer (DEQ, 1999), the inventory zone for the wells was delineated based on a 1,000-foot fixed radius.

Recharge Region – The recharge region for the Winnett source water is presumed to be located in the Big Snowy and Judith Mountains. The inventory for the recharge region focuses on general land uses and large industrial facilities. The goal of management in the recharge region is to maintain and improve the long-term quality of groundwater in the aquifer

4.0 INVENTORY

Significant potential contaminant sources in the source water management areas were inventoried to assess the susceptibility of Winnett's source water to contamination, and to provide a foundation for source water protection planning. The inventory for Winnett focuses on facilities or features that generate, use, store, or transport potential contaminants, as well as certain land uses in the inventory and recharge regions. It is important to remember that the sites and areas identified in this section are only potential sources of contamination to the drinking water. Contamination of drinking water sources is less likely when potential contaminants are properly used and managed.

4.1 INVENTORY METHOD

The inventory focus is slightly different in each of the delineated management areas. The inventory for the Winnett focuses on all activities in the control zone; certain types of facilities and land uses in the inventory region; and general land uses and large facilities in the Recharge Region. Information on facilities and land uses that are potential sources of regulated contaminants was obtained from a number of databases, described below. The process for completing the inventory included several steps, which are summarized as follows:

- Step 1: Land uses were identified from the U.S. Geological Survey's (USGS) Geographic Information Retrieval and Analysis System <<http://nris.state.mt.us/gis/datalist.html>>. Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.
- Step 2: The US Environmental Protection Agency's (EPA) Envirofacts System <<http://www.epa.gov/enviro/>> was queried to identify EPA-regulated facilities located in the management areas. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory System (TRIS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and the Permit Compliance System (PCS - for Concentrated Animal Feeding Operations with MPDES permits). The available reports

were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

- Step 3: Montana DEQ databases were queried to identify any of the following in the management areas:
 - Underground storage tanks (USTs)
<<http://www.deq.state.mt.us/UST/USTDownloads.asp>>
 - Hazardous waste contaminated sites, above ground storage tanks (ASTs), landfills, and abandoned and active mines, including gravel pits <<http://nris.state.mt.us/gis/bundler/>>

Any information on past releases and present compliance status was noted.

- Step 4: Major road and rail transportation routes were identified throughout the inventory region: <<http://nris.state.mt.us/gis/gisdata/lib/gisDataList.aspx>>.

Potential contaminant sources are considered significant if they fall into one or more of the following categories:

1. Large quantity hazardous waste generators.
2. Landfills.
3. Underground storage tanks.
4. Known groundwater contamination (including open or closed hazardous waste sites, state or federal Superfund sites, and leaking UST sites).
5. Underground injection well.
6. Major roads or rail transportation routes.
7. Cultivated cropland exceeding 20% of the inventory region.
8. Animal feeding operations.
9. Wastewater treatment facilities, sludge handling sites, or land application areas.
10. Septic systems.
11. Sewer mains.
12. Storm sewer outflows.
13. Abandoned or active mines

4.2 INVENTORY RESULTS

4.2.1 Control Zone Inventory Results

No potential sources of contamination were identified within the 100-foot radius control zone. The sanitary survey did not describe the wellhead, but according to the land use surveys, the well is located in grazing land. As a blanket statement, the control zone should be fenced off from any livestock, and drainage away from the wellhead should be maintained.

4.2.2 Inventory Region Results

The inventory results for Winnett's source water are summarized in Table 2, and are shown on [Figure 3](#). The inventory region includes agricultural land. No UST facilities were identified within the inventory region. Multiple LUST sites and one Superfund site were located in town, but outside of the inventory region. The Superfund site, the Weowna Refinery, has been accorded a low priority by the Montana DEQ, based on a lack of visual evidence of contamination.

The primary land use within the inventory region is grassland and shrubland. There is a small percentage of sewered urban land, which presents a low hazard to the source water. Septic system density within the inventory region is low and is not considered a hazard to the PWS drinking water. Additional point sources of potential pollutants (such as businesses or facilities listed on regulatory databases) were not identified in the inventory region.

4.2.3 Recharge Region Inventory Results

According to the 1992 National Land Cover dataset, the primary land use in the recharge region is grassland, with some agricultural (crop-fallow small grain) land use. Septic system density within the watershed/recharge region is low and is not considered a hazard to the PWS drinking water.

Additional sources of potential pollutions (such as businesses or facilities listed on regulatory databases) were not identified in the recharge region.

4.3 INVENTORY UPDATE

To make this SWDAR a useful document for the years to come, the certified water system operator should review the inventory every year. Changes in land uses or potential contaminant sources should be noted and additions made as appropriate. The complete inventory should be submitted to DEQ every five years to ensure the source water delineation and assessment remains current.

5.0 SUSCEPTIBILITY ASSESSMENT

5.1 INTRODUCTION TO SUSCEPTIBILITY

Susceptibility is the degree of likelihood for a public water supply to be impacted by inventoried contaminant sources, at concentrations that would pose a concern. Susceptibility is assessed to prioritize potential pollutant sources for local management, in this case the Winnett PWS managers and operators. Alternative management approaches that could be used by the PWS managers and operators to reduce susceptibility are recommended in this chapter.

5.2 DETERMINATION OF SUSCEPTIBILITY

According to the DEQ Source Water Protection Program (DEQ, 1999) Susceptibility is determined by considering the *hazard* rating for each potential contaminant source relative to any contaminant *barriers*. Proximity or density of significant potential contaminant sources and nature of contaminants determines hazard.

Barriers to contamination are anything that decreases the likelihood of contaminants reaching a spring or well. Barriers may be engineered structures, management actions, or natural conditions. Examples of engineered barriers include spill catchment structures and leak detection for underground storage tanks. Emergency planning and best management practices (BMPs) are considered management barriers. Thick clay-rich soils, a deep water table or a thick unsaturated zone above the well intake are examples of natural barriers. Multiple barriers are identified for the Winnett public water system: depth to the wells intakes, confined nature of the aquifer, and artesian flow.

5.3 RESULTS OF SUSCEPTIBILITY ASSESSMENT

A summary of the susceptibility assessment for the Winnett wells is provided in Table 2. This table only includes the potential contaminant sources (identified in the inventory) that were determined to present a significant potential risk to the drinking water supply. Therefore, this list is not exhaustive, and it is highly recommended that the PWS operator and community members familiar with the nature of businesses and land use in the area enhance the inventory through further research and local input.

Table 2. Susceptibility Assessment of Significant Potential Contaminant Sources

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard	Barriers	Susceptibility	Management Recommendations
<i>Inventory Region</i>						
Agricultural Land: Cropland and grazing lands	NO ₃ and SOCs from fertilizer, pesticides and herbicides. Pathogens from pastures.	Contaminants leaching into groundwater	Low	Intake depth Confined aquifer Artesian flow	Very Low	Encourage BMPs.
Septic Systems:	Pathogens, nitrate (NO ₃)	System failure could result in discharge of untreated effluent	Low	Intake depth Confined aquifer Artesian flow	Very Low	Encourage septic system owners to periodically inspect their septic systems.
Municipal Sewer Lines	Pathogens, nitrate (NO ₃)	Ongoing or catastrophic leakage of sewage into groundwater	Low	Intake depth Confined aquifer Artesian flow	Very Low	Ensure ongoing inspection and maintenance with rehabilitation or replacement of existing sewer mains if necessary. Use sewer main liners. Develop rapid response plan for leaks or ruptures.
<i>Recharge Region</i>						
Agricultural Crop Land	NO ₃ and SOCs from fertilizer, pesticides and herbicides. Pathogens (if grazing occurs)	Contaminants leaching into groundwater	Not assessed	Intake depth Confined aquifer Artesian flow	Not assessed outside inventory region	Encourage use of BMPs in the recharge region

6.0 LIMITATIONS

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment of the Winnett Public Water System (PWS) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). The following limitations should be noted:

- This report was prepared to assess the susceptibility of the Winnett PWS to significant potential contaminant sources, and is based on published information and information obtained from individuals familiar with the community. The terms “drinking water supply” or “drinking water source” refer specifically to the source of the Winnett public water supply and not any other public or private water supply. Also, not every potential or existing source of groundwater or surface water contamination in the Winnett area have been identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered
- The potential contaminant sources described in the inventory are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The use of multiple sources of information increases the likelihood that the major threats to the source water for Winnett’s public water supply have been identified. The inventory is not exhaustive. That a potential contaminant source is not identified in the inventory or susceptibility assessment of this report does not mean that the potential for contamination does not exist or there is not a threat. It is highly recommended that the PWS and community enhance or refine the identification of the potential contamination sources through further research and local input.

7.0 CONCLUSIONS

This Source Water Delineation and Assessment Report (SWDAR) was prepared under the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is completing these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the inventory region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

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The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region includes the area that is expected to supply groundwater recharge to the well over the next three years. Due to the depth to the Winnett PWS well intakes, this is delineated as a 1,000-foot fixed radius.

- Potential contaminant sources identified within the recharge region are limited to agricultural land.

The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage.

The Winnett public water supply has a very low susceptibility to the surrounding agricultural land. Nitrate has not been detected in the Winnett PWS water within the past five years, nor have coliform bacteria.

Low risk potential sources and potential sources located outside the inventory region, but within the recharge region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for the Winnett. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high, and prevention is preferable to treatment. Public awareness is a powerful tool for protecting drinking water. The information in this report will help increase public awareness about the relationship between land use activities and drinking water quality.

8.0 REFERENCES

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9.0 GLOSSARY

Acute Health Effect. A negative health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Aquifer. A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.

Barrier. A physical feature or management plan that reduces the likelihood of contamination of a water source from a potential contaminant source

Best Management Practices (BMPs). Methods for various activities that have been determined to be the most effective, practical means of preventing or reducing non-point source pollution.

Biennial Reporting System (BRS). An EPA database that contains information on hazardous waste sites. The data can be accessed through the EPA Envirofacts website.

Chronic Health Effect. A negative health effect in which symptoms develop over an extended period of time.

Class V Injection Well. Any pit or conduit into the subsurface for disposal of waste waters. The receiving unit for an injection well typically represents the aquifer, or water-bearing interval.

Coliform Bacteria. A general type of bacteria found in the intestinal tracts of animals and humans, and also in soils, vegetation and water. Their presence in water is used as an indicator of pollution and possible contamination by pathogens.

Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Passed in 1989 by the Montana State Legislature, CECRA provides the mechanism and responsibility to clean up hazardous waste sites in Montana.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). A database that provides information about specific sites through the EPA Envirofacts website.

Confined Animal Feeding Operation (CAFO). Any agricultural operation that feeds animals within specific areas, not on rangeland. Certain CAFOs require permits for operation.

Confined Aquifer. A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the overlying confining unit.

Confining Unit. A geologic formation present above a confined aquifer that inhibits the flow of water and maintains the pressure of the groundwater in the aquifer. The physical properties of a confining unit may range from a five-foot thick clay layer to shale that is hundreds of feet thick.

Delineation. The process of determining and mapping source water protection areas.

Glacial. Of or relating to the presence and activities of ice or glaciers. Also, pertaining to distinctive features and materials produced by or derived from glaciers.

Geographic Information Systems (GIS). A computerized database management and mapping system that allows for analysis and presentation of geographic data.

Hardness. Characteristic of water caused by presence of various calcium and magnesium salts. Hard water may interfere with some industrial processes and prevent soap from lathering.

Hazard. A relative measure of the potential of a contaminant from a facility or associated with a land use to reach the water source for a public water supply. The location, quantity and toxicity of significant potential contaminant sources determine hazard.

Hydraulic Conductivity. A constant number or coefficient of proportionality that describes the rate water can move through an aquifer material.

Hydrology. The study of water and how it flows in the ground and on the surface.

Hydrogeology. The study of geologic formations and how they effect groundwater flow systems.

Inventory Region. A source water management area for groundwater systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year groundwater travel time.

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes.

Large Capacity Septic System. Defined by Underground Injection Control regulations as an on-site septic system serving 20 or more persons.

Leaking Underground Storage Tank (LUST). A release from a UST and/or associated piping into the subsurface.

Maximum Contaminant Level (MCL). Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act to establish concentrations of contaminants in drinking water that are protective of human health.

Montana Bureau of Mines and Geology – Groundwater Information Center (MBMG/GWIC). The database of information on all wells drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national permitting system that utilizes a database to track entities that discharge wastewater into waters of the United States.

Nitrate. An important plant nutrient and type of inorganic fertilizer that can be a potential contaminant in water at high concentrations. In water the major sources of nitrates are wastewater treatment effluent, septic tanks, feed lots and fertilizers.

Nonpoint Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. Examples of nonpoint- source pollution include agriculture, forestry, and run-off from city streets. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of these chemicals into surface and/or groundwaters at increased levels that may exceed MCLs.

Pathogens. A microorganism typically found in the intestinal tracts of mammals, capable of producing disease.

Phase II (and IIB) Rules. EPA updated or created legal limits on 38 contaminants. The rules became effective July 30, 1992 and January 1, 1993. Some of these contaminants are frequently-applied agricultural chemicals such as nitrate and others are industrial solvents.

Phase V Rule. EPA set standards for 23 contaminants in addition to those addressed by the Phase II Rules. The Phase V Rule became effective January 17, 1994. Some of these contaminants include inorganic chemicals such as cyanide and other Phase V contaminants are pesticides that enter water supplies through run-off from fields where farmers have applied them or by leaching through the soil into groundwater. Six are probable cancer-causing agents. Others can cause liver and kidney damage, or problems of the nervous system and brain.

Point Source. A stationary location or a fixed facility from which pollutants are discharged. This includes any single identifiable source of pollution, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fracture, container, rolling stock (tanker truck), or vessel or other floating craft, from which pollutants are or may be discharged.

Pollutant. Generally, any substance introduced into the environment that adversely affects the usefulness of a resource (e.g. groundwater used for drinking water).

Permit Compliance System (PCS). An EPA database that provides information on the status of required permits for specific activities for specific facilities. The data can be accessed through the EPA Envirofacts website.

Public Water System (PWS). A system that provides water for human consumption through at least 15 service connections or regularly serves 25 individuals.

Pumping Water Level. Water level elevation in a well when the pump is operating.

Recharge Region. An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. As a source water management region, the term generally describes the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

Resource Conservation and Recovery Information System (RCRIS). Is a database that provides information about specific sites through the EPA Envirofacts website.

Secondary Maximum Contaminant Levels (SMCL). The maximum concentration of a substance in water that is recommended to be delivered to users of a public water supply based on aesthetic qualities. SMCLs are non-enforceable guidelines for public water supplies, set by EPA under authority of the Safe Drinking Water Act. Compounds with SMCLs may occur naturally in certain areas, limiting the ability of the public water supply to treat for them.

Section Seven Tracking System (SSTS). SSTS is an automated system EPA uses to track pesticide producing establishments and the amount of pesticides they produce.

Sensitivity. The relative ease with which contaminants can migrate to source water through the natural materials

Source Water. Any surface water, spring, or groundwater source that provides water to a public water supply.

Source Water Delineation and Assessment Report (SWDAR). A report for a public water supply that delineates source water protection areas, provides an inventory of potential contaminant sources within the delineated areas, and evaluates the relative susceptibility of the source water to contamination from the potential contaminant sources under "worst-case" conditions.

Source Water Protection Areas. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply. For groundwater sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.

Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.

Standard Industrial Classification (SIC) Code. A method of grouping industries with similar products or services and assigning codes to these groups.

Static Water Level (SWL). Water level elevation in a well when the pump is not operating.

Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man-made organic chemical compounds (e.g. herbicides and pesticides).

Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

Total Maximum Daily Load (TMDL). The total pollutant load to a surface water body from point, nonpoint, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

Toxicity. The quality or degree of being poisonous or harmful to plants, animals, or humans.

Toxicity Characteristic Leachate Procedure (TCLP). A test designed to determine whether a waste is hazardous or requires treatment to become less hazardous.

Toxic Release Inventory System (TRIS). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.

Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.

Turbidity. The cloudy appearance of water caused by the presence of suspended matter.

Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.

Volatile Organic Compounds (VOC). Chemicals such as petroleum hydrocarbons and solvents or other organic chemicals that evaporate readily to the atmosphere.

Watershed. The region drained by, or contributing water to, a stream, lake, or other water body of water.

FIGURES

APPENDIX A

PWS SANITARY SURVEY, SITE PLAN AND WELL LOG

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
TOWN OF WINNETT - WELL 1
Location Information

[Plot this site on a topographic map](#)

GWIC Id: 25991
 Location (TRS): 14N 27E 06 DAB
 County (MT): PETROLEUM
 DNRC Water Right: W125936-00
 PWS Id: 00364002
 Block:
 Lot:
 Addition:

Source of Data: COMBO
 Latitude (dd): 47.0025
 Longitude (dd): -108.3388
 Geomethod: TRS-TWN
 Datum: NAD27
 Altitude (feet):
 Certificate of Survey:
 Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 2153.00
 Static Water Level (ft):
 Pumping Water Level (ft): 524.00
 Yield (gpm): 15.00
 Test Type: PUMP
 Test Duration: 48.00
 Drill Stem Setting (ft):
 Recovery Water Level (ft):
 Recovery Time (hrs):
 Well Notes:

How Drilled: ROTARY
 Driller's Name:
 Driller License:
 Completion Date (m/d/y): 10/27/1972
 Special Conditions:
 Is Well Flowing?:
 Shut-In Pressure:
 Geology/Aquifer: Not Reported
 Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

From	To	Diameter
0.0	213.0	12.0
213.0	2153.0	7.0

Annular Seal Information

From	To	Description
0.0	213.0	CEMENTED

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	213.0	8.0				22 LB STEEL
213.0	2153.0	5.0				15 LB STEEL

Completion Information¹

From	To	Dia	# of Openings	Size of Openings	Description
1870.0	1892.0	5.0			JECTO GUN SLOTS
1930.0	1950.0	5.0			JECTO GUN SLOTS
1974.0	1978.0	5.0			JECTO GUN SLOTS
1992.0	1996.0	5.0			JECTO GUN SLOTS
2068.0	2070.0	5.0			JECTO GUN SLOTS

Lithology Information

From	To	Description
0.0	3.0	TOPSOIL
3.0	340.0	NIOBRARA SHALE
340.0	600.0	CARLISLE SHALE
600.0	656.0	GREENHORN LIMEY SHALE
656.0	728.0	BELLE FOURCHE SHALE
728.0	728.0	TOP OF MOWRY SHALE
728.0	1082.0	HARD BRITTLE SHALE W/LENSES OF FINE SAND
1082.0	1184.0	THERMOPOLIS SHALE
1184.0	1422.0	DARK GREY SHALE- BENTONITE
1422.0	1515.0	SKULL CREEK GREY SHALE
1515.0	1590.0	GREY MEDIUM-HARD SILTSTONE DAKOTA SILT
1590.0	1590.0	TOP OF 1ST CAT CREEK SAND
1590.0	1710.0	MED-HARD TIGHT FINE GRAINED SAND W/SHALE LENSES
1710.0	1710.0	TOP OF KOOTENAI FORMATION
1710.0	1804.0	MULTI-COLORED CLAY; PREDOMINATELY RED AND GREY
1804.0	1804.0	TOP OF 2ND CAT CREEK SAND
1804.0	1874.0	SOFT TO MED SOFT SAND-GOOD POROSITY- SOME CLAY PARTICLES
1874.0	1906.0	GREY AND RED SHALE
1906.0	1906.0	TOP OF 3RD CAT CREEK SAND
1906.0	1944.0	HARD SHARP- FINE GRAINED SAND
1944.0	1944.0	TOP OF MORRISON FORMATION

1944.0	2008.0	RED AND GREEN SHALE W/SOME LIMESTONE
2008.0	2043.0	MEDIUM-HARD TIGHT SAND
2043.0	2151.0	MULTI-COLORED SHALE AND LENSES OF SAND

¹ - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
TOWN OF WINNETT - WELL 2
Location Information

[Plot this site on a topographic map](#)

GWIC Id: 132759
Location (TRS): 14N 27E 06 DBDD
County (MT): PETROLEUM
DNRC Water Right: C055980-00
PWS Id: 00364003
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 47.0027
Longitude (dd): -108.3514
Geomethod: MAP
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 2151.00
Static Water Level (ft):
Pumping Water Level (ft): 693.00
Yield (gpm): 24.00
Test Type: PUMP
Test Duration:
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:

How Drilled: ROTARY
Driller's Name: EXPLORATION
Driller License:
Completion Date (m/d/y): 11/13/1983
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: 217KOTN
Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

From	To	Diameter
0.0	32.0	12.0
32.0	2151.0	8.0

Annular Seal Information

From	To	Description
0.0	2069.0	CEMENT

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	2069.0	7.0				20 LB STEEL

Completion Information¹

From	To	Dia	# of Openings	Size of Openings	Description
1815.0	1836.0	5.0			PERFORATED CASING
1906.0	1920.0	5.0			PERFORATED CASING
1934.0	1944.0	5.0			PERFORATED CASING
2008.0	2012.0	5.0			PERFORATED CASING

Lithology Information

From	To	Description
0.0	3.0	TOPSOIL
3.0	340.0	NIOBRARA SHALE
340.0	600.0	CARLISLE SHALE
600.0	656.0	GREENHORN LIMEY SHALE
656.0	728.0	BELLE FOURCHE SHALE
728.0	728.0	TOP OF MOWRY SHALE
728.0	1082.0	HARD BRITTLE SHALE W/LENSES OF FINE SAND
1082.0	1184.0	THERMOPOLIS SHALE
1184.0	1422.0	DARK GRAY SHALE BENTONITE
1422.0	1515.0	SKULL CREEK GRAY SHALE
1515.0	1590.0	GRAY MEDIUM HARD SILTSTONE DAKOTA SILT
1590.0	1590.0	TOP OF 1ST CAT CREEK SAND
1590.0	1710.0	MEDIUM HARD TIGHT FINE GRAINED SAND WITH SHALE LENSES
1710.0	1710.0	TOP OF KOOTENAI FORMATION
1710.0	1804.0	MULTI COLORED CLAY PREDOMINATELY RED AND GRAY
1804.0	1804.0	TOP OF 2ND CAT CREEK SAND

1804.0	1874.0	SOFT TO MEDIUM SOFT SAND GOOD POROSITY SOME CLAY PARTICLES
1874.0	1906.0	GRAY AND RED SHALE
1906.0	1906.0	TOP OF 3RD CAT CREEK SAND
1906.0	1944.0	HARD SHARP FINE GRAINED SAND
1944.0	2008.0	RED AND GREEN SHALE W/SOME LIMESTONE
2008.0	2043.0	MEDIUM HARD TIGHT SAND
2043.0	2151.0	MULTICOLORED SHALE AND LENSES OF SAND

¹ - All diameters reported are **inside** diameter of the casing.

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. Note: non-reported casing, completion, and lithologic records may exist in paper files at GWIC.

APPENDIX B

WATER QUALITY ANALYTICAL REPORT

APPENDIX C

SOURCE WATER MONITORING WAIVERS

MONITORING WAIVERS

Waiver Recommendation

The Winnett PWS has a waiver for Phase 2 inorganics. Under the waiver, the PWS samples for these parameters every nine years rather than every three years. The PWS was grandfathered under the radionuclide rule and is only required to sample once every nine years for these parameters.

Before a susceptibility or use waiver is requested, the PWS Operators are encouraged to carefully review the Monitoring Waiver Requirements, described below. If after reviewing this section it is determined that an additional waiver is feasible, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. The PWS must be in compliance with monitoring requirements to be considered. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region. The table below shows how identified potential contaminant sources affect the eligibility for monitoring waivers.

Susceptibility Assessment as it relates to Waiver Eligibility

Source	Contaminant	Susceptibility	Waiver Eligibility
Transportation Corridors	VOCs, SOCs, petroleum products and other chemicals		Chemical use in right-of-way may preclude waivers for some chemicals. PWS should confirm chemical use history along the right-of-way. Waivers might be rescinded if a spill occurred.
Sewer System/ Wastewater Treatment	Nitrates, pathogens		Waivers are not available for pathogens and nitrate.
Agricultural Cropped Areas	Nitrates and SOCs		Chemical use may preclude waivers for some chemicals. The PWS should confirm chemical use/storage history by land parcel.

Monitoring Waiver Requirements

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls (PCBs) are excluded from monitoring requirements by statewide waivers.

Use Waivers

A Use Waiver can be allowed if through a vulnerability assessment, it is determined that specific organic chemicals were not used, manufactured, or stored in the area of a water source (or source area). If certain organic chemicals have been used, or if the use is unknown, the system would be determined to be vulnerable to organic chemical contamination and ineligible for a Use Waiver for those particular contaminants.

Susceptibility Waivers

If a Use Waiver is not granted, a system may still be eligible for a Susceptibility Waiver, if through a vulnerability assessment it is demonstrated that the water source would not be susceptible to contamination. The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical

contaminants are in the area of investigation. The vulnerability assessment of a surface water source must consider the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of one mile as an area of investigation for the use of organic chemicals. Vulnerability assessment of spring water sources should use a minimum fixed radius of one mile as an area of investigation for the use of organic chemicals. Surface water and shallow groundwater sources under the direct influence of surface water (GWUDISW) should assess the watershed area above the source, or a minimum fixed radius of one and one-half miles upgradient.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include well logs, pump test data, water quality monitoring data from surrounding public water systems, delineation of zones of influence and contribution to a well; time-of-travel or attenuation studies; vulnerability mapping; and the use of computerized groundwater flow and transport models. DEQ's PWS Section and DEQ's Source Water Protection Program will conduct review of an organic chemical monitoring waiver application. Other state agencies may be asked for assistance.

Susceptibility Waiver for Unconfined Aquifers

Unconfined aquifers are the most common source of usable groundwater. Unconfined aquifers are not contained within impervious geologic strata. As a result, the upper groundwater surface, or water table, in an unconfined aquifer is not under the pressure that produces hydrostatic head common to confined aquifers.

Unconfined aquifers are usually locally recharged from surface water or precipitation. In general, groundwater flow gradients in unconfined aquifers reflect surface topography, and the residence time of water in the aquifer is generally shorter than for water in confined aquifers. Similar water chemistry often exists between unconfined groundwater and area surface water, and physical parameters and dissolved constituents can be an indicator of the hydraulic connection between groundwater and surface water. Consequently, unconfined aquifers can be susceptible to contamination by organic chemicals migrating from the ground surface to groundwater.

Properly assessing a susceptibility waiver application for an unconfined source aquifer requires: site-specific information pertaining to the location and construction of the source development, monitoring history of the source, geologic characteristics of the unsaturated soil and vadose zones, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The zone of contribution of the unconfined groundwater source must be defined and plotted. This should describe the groundwater flow directions, gradients, and a 3-year time-of-travel. All surface water bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and those nearby should be provided as well.

Susceptibility Waiver for Confined Aquifers

Confined groundwater is isolated from overlying material by relatively impermeable geologic units. A confined aquifer is generally subject to pressures greater than atmospheric pressure. A well that is screened in a confined aquifer will have a static water level that determined by the pressure (hydrostatic head) at the top of the aquifer.

The susceptibility of a confined aquifer relates to the probability of an introduced contaminant to travel from the source of contamination to the aquifer. Important hydrogeologic controls include the depth of the aquifer, the permeability of the soil and vadose zones, the thickness and uniformity of low permeability and confining layers between the surface and the aquifer, and hydrostatic head of the aquifer.

A confined aquifer may eventually be affected by contaminated groundwater from elsewhere in the recharge area. Improper well construction or abandonment can act as a hydraulic connection to the confined aquifer. The extent of confinement of an aquifer is critical to limiting susceptibility to organic chemical contamination. The extent of confinement must be demonstrated by the PWS in order to be considered for a confined aquifer susceptibility waiver. Typical information includes: pump test data (storage coefficient), geologic mapping, well logs, water quality history, and available information related to any other wells, active or abandoned, in the recharge region.

APPENDIX D

CONCURRENCE LETTER

Filename: C6FFA0F2.htm
Directory: C:\Documents and Settings\CB1196\Local Settings\Temporary Internet
Files\Content.MSO
Template: C:\Documents and Settings\CB1196\Application
Data\Microsoft\Templates\Normal.dotm
Title: Montana DEQ - Source Water Assessment Town of Winnett
Subject:
Author: ES
Keywords:
Comments:
Creation Date: 11/30/2006 2:14:00 PM
Change Number: 4
Last Saved On: 8/31/2010 3:19:00 PM
Last Saved By: Wittenberg, Joyce
Total Editing Time: 343 Minutes
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As of Last Complete Printing
Number of Pages: 37
Number of Words: 9,295 (approx.)
Number of Characters: 53,173 (approx.)