

**TURNER SCHOOL DISTRICT NO. 43**  
**PUBLIC WATER SYSTEM**

**PWS ID No. MT0000723**

**SOURCE WATER DELINEATION & ASSESSMENT**  
**REPORT**

PREPARED BY:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY  
SOURCE WATER PROTECTION PROGRAM

PREPARED FOR:

Darel H. Hauge  
*Certified Operator*

PO Box 75  
Turner, Montana, 59542

April 2005





## EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared as required by the Federal Safe Drinking Water Act, according to a detailed Source Water Assessment Plan developed by a statewide Montana citizens' advisory committee, and approved by the US Environmental Protection Agency. The Department of Environmental Quality (DEQ) is completing assessment and delineation reports for all public water systems in Montana. These reports are intended to provide information so that the public water system staff/operator, consumers, and community citizens can develop strategies to protect drinking water sources. The information provided includes the delineation of the area most critical to maintaining safe drinking water (the inventory region), an inventory of significant potential sources of contamination within this area, and an assessment of the relative threat that these sources pose to the water system.

The Turner School District No. 43's drinking water is supplied by one well. According to the Source Water Protection Program (DEQ, 1999) the source water aquifer is considered to have **moderate sensitivity** to potential contamination, since the source aquifer is confined unconsolidated sand and gravel.

As part of this assessment, three types of source water protection management areas were mapped for the Turner School District No. 43 public water system. They are: the control zone, the inventory region, and the recharge region. The inventory region was delineated as a one-mile fixed radius circle. Potential sources of contamination were inventoried within these three regions and the results are as follows:

- No potential sources of contamination were identified within the control zones. 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 circle of 100-foot radius around the wellhead. All sources of potential contaminants should be excluded from the control zone.
- One active underground storage tank (UST) site and one active and leaking UST (LUST) site were identified within the inventory region. The portion of the inventory region immediately around the PWS is sewerage. A high percentage of the inventory region is cropland agricultural land.
- The recharge region is sparsely populated. Septic system density is low. Crop-fallow agriculture is widespread in the recharge region.

Coliform bacteria have been detected repeatedly in the Turner School PWS water within the past five years. Fecal coliform bacteria have not been detected, however. Nitrate is detected regularly, at concentrations ranging from 1.14 mg/L to 23.2 mg/L. The abrupt increases in nitrate concentration correspond to failures of the osmotic membrane. Fluoride has been detected in each sampling round, at concentrations around .5 mg/L, well below the MCL of 4 mg/L. Sulfate has been detected as high as 791 mg/L, higher than the SMCL of 250 mg/L.

Low risk potential sources and potential sources located outside the inventory region, but within the region that contributes recharge to the aquifer may still pose a threat over time, but are not considered in this assessment. The susceptibility analysis is intended to provide the operator with information on where the greatest risk occurs.

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.



## TABLE OF CONTENTS

1.0	Introduction .....	1
2.0	Background .....	1
2.1	Physical Setting.....	1
2.1.1	Geography and Geology .....	1
2.1.2	Climate.....	1
2.1.3	Source Water.....	2
2.2	The Public Water Supply .....	2
2.2.1	Water Supply System.....	2
2.2.2	Supply Well Information .....	2
2.3	Water Quality.....	2
2.3.1	Public Water Supply Monitoring Results .....	3
2.3.2	Background Water Quality Monitoring Results .....	3
3.0	Management Area Delineation.....	3
3.1	Delineation .....	3
4.0	Inventory .....	4
4.1	Inventory Method.....	4
4.2	Inventory Results .....	5
4.2.1	Control Zone Inventory Results.....	5
4.2.2	Inventory Region Results.....	5
4.2.3	Recharge Region Results .....	5
5.0	Susceptibility Assessment .....	5
6.0	Limitations .....	8
7.0	Conclusions .....	9
8.0	References .....	10
9.0	Glossary.....	11

## FIGURES

[Figure 1 – Public Water Supply Location](#)

[Figure 2 – Geology of the Turner Area](#)

## APPENDICES

- Appendix A - Well Logs and PWS Sanitary Survey
- Appendix B - Water Quality Analytical Results
- Appendix C - UST / LUST Database Query Results
- Appendix D - Wellhead Protection Plan
- Appendix E - Concurrence Letter



## 1.0 INTRODUCTION

The primary purpose of this source water delineation and assessment report (SWDAR) is to provide information that helps the Turner School District No. 43 public water supply (PWS) protect its drinking water sources. The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies. The Turner School District No. 43 PWS is classified as a nontransient, noncommunity PWS, as it serves more than 25 of the same people for more than six months of the year.

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment of the Turner School District No. 43 Public Water System as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 [U.S. Code Title 42, Chapter 6A, Subchapter XII, Part E, § 300j-13-(a) Source Water Assessment].

Eric Sivers, a hydrogeologist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Section, completed the Turner School District No. 43 (PWS ID No. MT0000723) Source Water Delineation and Assessment Report. Information on the PWS was obtained from the 1998 Wellhead Protection Plan completed by the Turner 9<sup>th</sup> Grade earth science class, under the guidance of teacher John Ladanye and Ginette Abdo of the Montana Bureau of Mines and Geology (MBMG). The most recent sanitary survey (June 1999) was also used to provide further information regarding the PWS. Additional references are detailed at the end of this report.

## 2.0 BACKGROUND

The Turner School District No. 43 is located in northeastern Blaine County in north-central Montana, approximately 70 miles northeast of Havre ([Figure 1](#)). According to the Census Bureau, the population of Blaine County in 2000 was 7,009, with approximately 64 persons living in Turner. Turner School District No. 43 is attended by students from the surrounding area, ranging in age from kindergarten to senior high school. The school PWS provides water to approximately 135 persons.

### 2.1 PHYSICAL SETTING

#### 2.1.1 Geography and Geology

Turner sits on the northern glaciated plains, at an elevation of approximately 3,000 feet above mean sea level. The community is located on state highway 241, several miles south of the Canadian border.

Turner sits on a plateau of the Tertiary Flaxville Gravel. This unit was deposited in broad sheets by streams predating the Pleistocene glaciation, and has been subsequently dissected by later drainage patterns. It is a relatively coarse body of gravel and sand, locally cemented with calcium carbonate. In the Turner area, the Flaxville overlies the Cretaceous Bearpaw Formation. These geologic units have been mantled with a layer of Quaternary age till, which was deposited by successive stages of continental glaciation.

#### 2.1.2 Climate

Climate in the area is semi-arid, and typical of north-central Montana. Annual total precipitation is 11.5 inches, and generally occurs May through September. The area receives an annual average of 25 inches of snow, mainly from December to February. The climate summary is based upon records from the climate station at Turner. Climate data is 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: Turner Climate Station (248413)**

Period of Record: 07/01/1948 to 09/30/1984

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Ave. Max. Temp (F)	20.3	29.1	37.2	54.2	66.6	74.9	83.1	83.2	70.7	58.3	40.0	26.7	53.7
Ave. Min. Temp. (F)	-0.8	7.3	14.7	28.2	38.7	46.5	51.5	50.3	40.1	31.1	17.4	6.3	27.6
Ave Tot. Precip. (in.)	0.35	0.29	0.40	0.81	1.76	2.50	1.96	1.21	1.05	0.59	0.27	0.32	11.50
Ave. Tot. Snowfall (in.)	7.0	3.9	4.0	2.8	0.1	0.1	0.0	0.0	0.1	1.2	1.7	4.1	25.0
Ave Snow Depth (in.)	3	4	4	0	0	0	0	0	0	0	0	1	1

### 2.1.3 Source Water

According to the well log, the well derives water from gravels of the Flaxville Formation. This aquifer is confined by a twenty-foot thick mantle of clay-rich sediments, probably glacial till. The aquifer is most likely recharged locally, along the extent of the gravel plateau.

According to the Source Water Protection Program (DEQ, 1999) the source water aquifer for the wells is considered to have **moderate sensitivity** to potential contamination, since the source aquifer is confined unconsolidated sand and gravel.

## 2.2 THE PUBLIC WATER SUPPLY

### 2.2.1 Water Supply System

One well provides groundwater to the system. The PWS distributes water through one service connection. The water is treated by a reverse osmosis (RO) system. The Turner School District No. 43 PWS is classified as a nontransient, noncommunity public water system since it serves more than 25 of the same persons for more than six months of the year.

### 2.2.2 Supply Well Information

One well (Well 3) provides water to the PWS. The well was drilled in 1990. The well is grouted with cement from grade to 18 feet below grade. The well is 59.5 feet deep and yields 50 gallons per minute. The well is cased with six-inch steel, and screened in sand and gravel from 57 to 59.5 feet below grade. The log reported 20 feet of clay-rich sediments overlying the sand and gravel. The static water level is reported to be 46 feet below grade.

## 2.3 WATER QUALITY

Each PWS performs regular sampling of its water supply to detect contamination. The analytical parameters for a community PWS include: coliform bacteria, nitrates, metals, petroleum hydrocarbons, and synthetic organic chemicals. The monitoring schedule depends on factors such as the type of PWS, type of source water, the number of supplies (e.g. wells or springs), and the population served. Monitoring programs are tailored to each system, following the general protocols defined by DEQ and the US EPA. Monitoring schedules are available online at: <http://nris.state.mt.us/wis/swap/swapquery.asp>. The Turner School District No. 43 PWS monitoring data from DEQ's database for the past five years was reviewed and is summarized in this section. Analytical results are reported in units of milligrams per liter (mg/L, equivalent to one part per million) or micrograms per liter (µg/L, equivalent to one part per billion). The results are

compared to quality standards established by the US EPA. Maximum Contaminant Levels (MCLs) are enforceable standards limiting the amount of a contaminant 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 been detected repeatedly in the Turner School PWS water within the past five years. Fecal coliform bacteria have not been detected, however. Nitrate is detected regularly, at concentrations ranging from 1.14 mg/L to 23.2 mg/L. The abrupt increases in nitrate concentration indicate when the osmotic membrane in the RO treatment is no longer functioning. Fluoride has been detected in each sampling round, at concentrations around .5 mg/L, well below the MCL of 4 mg/L. Sulfate has been detected as high as 791 mg/L, higher than the SMCL of 250 mg/L.

The water quality results are attached as Appendix B.

### 2.3.2 Background Water Quality Monitoring Results

Background water quality samples are collected from untreated water, whereas water quality samples of PWS water are collected from treated water. MBMG collected a background water quality sample from the Turner School PWS in 1996. Analytes typically include general water quality parameters: major dissolved ions (calcium, magnesium, sodium, potassium, iron, manganese, silica, bicarbonate, carbonate, chloride, sulfate, nitrate, fluoride and orthophosphate), trace elements, and metals.

The water quality analyses show that with the exception of high nitrate and sulfate levels, the background water quality is otherwise good. Nitrate was detected at a concentration of 12.7 mg/L, and sulfate was detected at a concentration of 526 mg/L. The water is considered hard (high dissolved CaCO<sub>3</sub> of 650 mg/L). The background water quality data is attached as Appendix B.

## 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. Methods and criteria for delineating source water protection areas for public water supplies are specified in the Montana Source Water Protection Program (DEQ, 1999).

### 3.1 DELINEATION

*Control Zone* – A 100-foot radius control zone is delineated around the wellhead. Ideally, all sources of potential contaminants would be excluded from this area.

*Inventory Region* – The inventory region is generally the area that is expected to contribute to the water supply over three years; this is sometimes referred to as a three-year capture zone. All potentially significant contaminant sources are inventoried in this region. In this case, the inventory region for the well is delineated as a one-mile fixed-radius circle. This method is the default method for nontransient, noncommunity public water supplies. The delineated inventory region is illustrated on [Figure 2](#).

*Recharge Region* – The recharge region is the area that contributes water to the source aquifers. The recharge region for the Turner School PWS probably extends over much of the upgradient portion of the gravel plateau.

## 4.0 INVENTORY

Significant potential contaminant sources in the source water management areas were inventoried to assess the susceptibility of the Turner School District No. 43 PWS source water to contamination, and to provide a foundation for source water protection planning. The inventory for the PWS 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 sources 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 managed.

### 4.1 INVENTORY METHOD

Information on facilities and land uses that are potential sources of regulated contaminants was obtained from a number of databases. The process for completing the inventory includes the following:

- Step 1: The Montana State Library Natural Resources Information System (NRIS) GIS database was queried to identify septic land application sites, wastewater treatment plants, animal feeding operations, septic system density, sewer systems, and agricultural land uses.
- Step 2: The DEQ PWS files were reviewed to identify agricultural activities or wastewater treatment in the vicinity of the PWS.
- Step 3: 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 4: 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://nr.is.state.mt.us/gis/bundler/>>

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

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
7. Cultivated cropland exceeding 20% of the inventory region.
8. Animal feeding operations.
9. Wastewater treatment facilities, sludge

- (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.
  - 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 significant potential sources of contamination were identified within the 100-foot radius control zone. As a blanket statement, the control zone should be isolated from traffic and passers-by, and drainage away from the wellhead should be maintained.

### 4.2.2 Inventory Region Results

Three UST/LUST facilities were identified in the inventory region. One of these LUST sites is active (Doyle Airspray), as illustrated on the database query results (Appendix C). This site is located in a presumed downgradient direction from the school. One active UST facility is located in the inventory region (Farmers' Union Oil Co.). The area around the PWS is mapped as sewered, and the septic system density over much of the inventory region is mapped as low. The majority of the inventory region is crop-fallow agricultural land. Some commercial and industrial development is present in the inventory region, including the UST facilities mentioned above. This may include other types of businesses that use, generate, transport or store regulated or hazardous materials. A state highway passes through the inventory region.

Two remediation response sites were identified within the inventory region. The DEQ database reported that pesticides were detected at the Turner school (Dicamba) and at Doyle Flying Service (Dicamba, 2,4-D, and Picloram). In both cases the detected concentrations were considerably below the standard, and the DEQ Remediation Division determined that there were no threats to human health or the environment in these instances.

Of the identified potential contaminant sources, the Source Water Protection Program has determined that **significant** potential contaminant sources are limited to: the agricultural land, the sanitary sewers, and the UST/LUST sites. The PWS' susceptibility to these potential contaminants will be assessed in Section 5, and presented in Table 2.

### 4.2.3 Recharge Region Results

The recharge region inventory is limited to certain land uses; PWS susceptibility to these uses is not assessed. Crop-fallow agriculture dominates the recharge region. No sanitary sewers lines are present, and septic system density is low.

## 5.0 SUSCEPTIBILITY ASSESSMENT

*Susceptibility* is the degree of likelihood for a public water supply to be impacted by inventoried contaminant sources. Susceptibility is determined in accordance with the DEQ Source Water Protection Program (DEQ, 1999). This guidance document is available on the DEQ Source Water Protection website (see the Reference section), or by request.

Susceptibility is determined by considering the *hazard* that significant potential contaminant source presents to the PWS source water, relative to any *barriers* to the contaminant. Hazard is determined by the proximity or density of significant potential contaminant sources, according to a formula laid out in the Source Water Protection Program (DEQ, 1999). Barriers to contamination are anything that decreases the likelihood of contaminants reaching a water source. The Turner PWS is credited with one natural barrier: thick confining layers.

Inventory results and management recommendations for the Turner School District No. 43 well are provided in Table 2.

**Table 2. Susceptibility Assessment of Significant Potential Contaminant Sources**

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard	Barriers	Susceptibility	Management Recommendations
<i>Inventory Region</i>						
Municipal Sewer Lines	Pathogens, nitrate (NO <sub>3</sub> )	Ongoing or catastrophic leakage of sewage	High	Confining layers	Moderate	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.
Septic Systems	Pathogens, nitrate (NO <sub>3</sub> )	System failure could result in discharge of untreated effluent	Low	Confining layers	Very low	Encourage septic system owners to periodically inspect their septic systems.
USTs and LUSTs	VOCs	Release of petroleum hydrocarbons to soil and groundwater	Moderate	Confining layers 1998 upgrades, site cleanup, groundwater monitoring	Low	Review permit status; ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, spill prevention, and BMPs. Properly abandon and remove tanks if out-of-service. Encourage soil testing to evaluate potential impact from historic spills or leaks.
Agricultural Land: Cropland and grazing lands	NO <sub>3</sub> and SOC <sub>s</sub> from fertilizer, pesticides and herbicides. Pathogens from pastures.	Contaminants leaching into groundwater	Very high	Confining layers	High	Encourage BMPs. Encourage awareness of how human activities may impact source water.
<i>Other Potential Contaminant Sources, not rated significant</i>						
Commercial or industrial users, transporters, and generators of hazardous materials	Petroleum products, maintenance products, VOCs, SOC <sub>s</sub> and others	Spills or leaks of chemicals used	Low	Confining layers	Very low	Protect areas from fuel or other chemical spills. Maintain sealed concrete floors. Ensure proper chemical and waste use, storage, and disposal/recycling. Ensure good housekeeping.
Transportation corridors	Fuels, chemicals, VOCs, SOC <sub>s</sub>	Spills, spraying	Very low	Confining layers	Very low	Become acquainted with emergency response procedures. Encourage agencies to reduce weed spraying along corridors.
<i>Recharge Region</i>						
Agricultural Land: Cropland and grazing lands	NO <sub>3</sub> and SOC <sub>s</sub> from fertilizer, pesticides and herbicides. Pathogens from pastures.	Contaminants leaching into groundwater	Not assessed	Not assessed	Not assessed	Encourage BMPs.

## 6.0 LIMITATIONS

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment of the Turner School District No. 43 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 [U.S. Code Title 42, Chapter 6A, Subchapter XII, Part E, § 300j-13-(a) Source Water Assessment]. The following limitations should be noted:

- Not every potential or existing source of groundwater or surface water contamination in the Turner School District No. 43 area has been identified. Consideration was limited to potential sources of contamination that are within the inventory region and of a type determined by the DEQ to be significant.
- The inventory region was delineated on a one-mile fixed radius of the wellhead. The DEQ SWP section has determined that this delineation method is appropriate for nontransient, noncommunity systems.
- The recharge region was delineated on the basis of available geologic maps and the lithologies identified in the well log. This is not a detailed hydrogeologic investigation, and a detailed and accurate delineation of the recharge area would require field investigations beyond the scope of this report.
- The potential contaminant sources described in the inventory are identified from readily available information, as described in Chapter 4. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. Multiple data sources are used to increase the likelihood that major threats to the source water are identified. The inventory is not exhaustive. Absence of a potential contaminant in the inventory or susceptibility assessment of this report does not mean that the potential for contamination does not exist, or that there is no threat.

## 7.0 CONCLUSIONS

The Turner School District No. 43's drinking water is supplied by one well. According to the Source Water Protection Program (DEQ, 1999) the source water aquifer is considered to have **moderate sensitivity** to potential contamination, since the source aquifer is confined unconsolidated sand and gravel.

As part of this assessment, three types of source water protection management areas were mapped for the Turner School District No. 43 public water system. They are: the control zone, the inventory region, and the recharge region. The inventory region was delineated as a one-mile fixed radius circle. Potential sources of contamination were inventoried within these three regions and the results are as follows:

- No potential sources of contamination were identified within the control zones. 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 circle of 100-foot radius around the wellhead. All sources of potential contaminants should be excluded from the control zone.
- One active underground storage tank (UST) site and one active and leaking UST (LUST) site were identified within the inventory region. The portion of the inventory region immediately around the PWS is sewered. A high percentage of the inventory region is cropped agricultural land.
- The recharge region is sparsely populated. Septic system density is low. Crop-fallow agriculture is widespread in the recharge region.

Coliform bacteria have been detected repeatedly in the Turner School PWS water within the past five years. Fecal coliform bacteria have not been detected, however. Nitrate is detected regularly, at concentrations ranging from 1.14 mg/L to 23.2 mg/L. The abrupt increases in nitrate concentration correspond to failures of the osmotic membrane. Fluoride has been detected in each sampling round, at concentrations around .5 mg/L, well below the MCL of 4 mg/L. Sulfate has been detected as high as 791 mg/L, higher than the SMCL of 250 mg/L.

Low risk potential sources and potential sources located outside the inventory region, but within the region that contributes recharge to the aquifer may still pose a threat over time, but are not considered in this assessment. The susceptibility analysis is intended to provide the operator with information on where the greatest risk occurs.

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

- Bergantino, R.N., Patton, T.W., Sholes, M.A., 2003. Geologic and structure contour map of the Harlem 30' x 60' quadrangle, north-central Montana, Montana Bureau of Mines and Geology Open File Report 468, 7 page(s), scale 1:100,000.
- Montana Bureau of Mines and Geology, 2005. Groundwater Information Center, lithologic well logs. <http://mbmgwic.mtech.edu/>
- Montana Department of Environmental Quality Public Water Supply Section, 2004. Safe Drinking Water Information System (SDWIS).
- Montana Department of Environmental Quality (DEQ), 1999. Montana Source Water Protection Program. <http://www.deq.state.mt.us/ppa/p2/swp/index.asp>
- Montana Natural Resources Information Interactive Map website. 2005. <http://nris.state.mt.us/interactive.html>
- Porter, K.W., Wilde, E.M. and S.M. Vuke, 1996. Preliminary Geologic Map of the Big Snowy Mountains 30' x 60' Quadrangle, Central Montana (Revised 2/05). Montana Bureau of Mines and Geology. Open File Report MBMG 341.
- Safe Drinking Water Act (SDWA) Amendments of 1996 [U.S. Code Title 42, Chapter 6A, Subchapter XII, Part E, § 300j-13-(a) Source Water Assessment].
- United States Census Bureau, 2000. [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)
- United States Geological Survey. 1992. National Landcover Dataset, Montana. 30-meter electronic digital landcover dataset. <http://nris.state.mt.us/nsdi/nris/nlcd/nlcdvector.html>
- Various Authors, 2000-2005. Correspondence in DEQ's PWS files regarding the Turner School District No. 43 Water Supply.

## 9.0 GLOSSARY

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.

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.

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.

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.

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.

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

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.

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.

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).

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 in a well when the pump is operating.

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.

Static Water Level (SWL). Water level 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.

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.

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

## **FIGURES**



**APPENDIX A**

**WELL LOG & PWS SANITARY SURVEY**



Montana Bureau of Mines and Geology  
 Ground-Water Information Center Site Report  
 TURNER SCHOOL DISTRICT #43

[Plot this site on a topographic map](#)  
[View Hydrograph for this Site](#)  
[View Water Quality for this Site](#)

Location Information

GWIC Id: 121807  
 Location (TRS): 36N 25E 25 CDAB  
 County (MT): BLAINE  
 DNRC Water Right: C161372-00  
 PWS Id: 00723003  
 Block: 10  
 Lot:  
 Addition: TURNER TOWNSITE

Source of Data: LOG  
 Latitude (dd): 48.8473  
 Longitude (dd): -108.4030  
 Geomethod: MAP  
 Datum: NAD27  
 Altitude (feet): 3041.90  
 Certificate of Survey:  
 Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 59.50  
 Static Water Level (ft): 46.00  
 Pumping Water Level (ft): 56.00  
 Yield (gpm): 50.00  
 Test Type: AIR  
 Test Duration: 2.00  
 Drill Stem Setting (ft):  
 Recovery Water Level (ft):  
 Recovery Time (hrs):  
 Well Notes:

How Drilled: FORWARD ROTARY  
 Driller's Name: HICKEL AND TOOKE  
 Driller License: WWC196  
 Completion Date (m/d/y): 8/20/1990  
 Special Conditions:  
 Is Well Flowing?:  
 Shut-In Pressure:  
 Geology/Aquifer: 121FLXV  
 Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

From	To	Diameter
0.0	60.0	6.0

Annular Seal Information

From	To	Description
0.0	18.0	CEMENT AND WATER

Lithology Information

From	To	Description
0.0	22.0	CLAY
22.0	59.5	GRAVEL

Casing Information<sup>1</sup>

From	To	Dia	Wall Thickness	Pressure Rating	Joint Type
-1.5	60.0	6.0			STEEL

Completion Information<sup>1</sup>

From	To	Dia	# of Openings	Size of Openings	Description
57.0	60.0	6.0		1/8	SLOTS

<sup>1</sup> - 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 RESULTS**



**APPENDIX C**

**UST / LUST DATABASE SEARCH RESULTS**



**APPENDIX D**

**WELLHEAD PROTECTION PLAN**



**APPENDIX E**

**CONCURRENCE LETTER**