

***SOURCE WATER DELINEATION AND
ASSESSMENT REPORT***

**Richland County Valley View
WUA
Public Water Supply
PWSID # MT0000514**

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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared as required by the Federal Safe Drinking Water Act and in accordance with Montana's Source Water Assessment Plan. The Department of Environmental Quality (DEQ) is completing assessment and delineation reports for all public water systems in Montana. Source water assessment is the first step towards source water protection. These reports are intended to provide information and help public water system staff/operator, consumers, and community citizens to 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.

This PWS's uses ground water as its source of drinking water and uses two wells to provide water to its residents. According to the Source Water Protection Program (DEQ, 1999) the aquifer used by this public water supply is considered to have **low sensitivity** to potential contamination, since the aquifer is comprised of deep confined consolidated sandstone that is part of the Fox Hills – Hell Creek Formation.

As part of this assessment, three types of source water protection areas are mapped or delineated. They are: the control zone, the inventory region, and the recharge region. The control zone (sometimes called the exclusion zone) is a 100-foot radius circle around the wellhead. The goal of management in the control zone is to avoid introducing contaminants directly into the well or immediate surrounding areas. The inventory region is the area that is expected to contribute ground water to the wells over a period of months or years (DEQ, 1999); in this case because the aquifer used by the subdivision is deep and confined, the inventory region is delineated as a 1,000 foot circle around each well. The recharge region represents the area that is expected to contribute water to the well over long periods of time. Potential sources of contamination were inventoried within the control zone and inventory region and the results are as follows:

The control zone for the primary Well 2 includes undeveloped land with no potential sources of contamination. The backup Well 1 control zone includes a portion of developed and undeveloped lots and part of a local access road. The developed lot closest to Well 1 is assumed to be served by an on-site septic system.

The inventory regions for both wells have low septic system density. Most of the land area in the vicinity of the subdivision is undeveloped with irrigated agricultural land located west – southwest of the wells.

Within the recharge region only potential sources of pathogens and nitrate are evaluated or inventoried. These efforts focus primarily on land use patterns. The recharge region is essentially the watershed up-gradient or up-stream of the PWS. This region is dominated by agricultural land use. Agricultural land is considered to be a significant potential contaminant source. The concern here is that over application of fertilizers and/or pesticides can result in the ag-chemicals infiltrating into ground water and running off in to surface water bodies that may be hydraulically connected to aquifers. A highway, state superfund site, and an oil pipeline are located in the recharge region. Significant potential contaminant sources within the recharge region, like irrigated ag-land, may still pose a threat over time, they are not included in the susceptibility analysis in this report. Possible management options however are included at the end of this report.

The susceptibility analysis is intended to provide the operator with information on what the greatest risk or threats to the source water are. Maps included in this report show where the potential contaminant sources that pose a threat to the source water are located relative to the public water supply wells. The assessment is focused on potential contaminant sources that the Source Water Protection Section has determined to be significant. These are detailed in Chapter 4.

Mitigating and managing some of the potential sources of contamination identified within the inventory region are often beyond the scope of what a PWS operator can accomplish or has the authority to change. The Source Water Protection Program acknowledges this and recommends that whenever possible, public water supplies work together and work with local, county, and state officials to find ways to protect source water. To this end, the Source Water Protection Program offers assistance to individual public water supplies and communities in developing source water protection plans. These plans use delineation and assessment reports like this one as a starting point to develop and implement strategies to protect source water, identify alternate sources of water, and develop emergency procedures. The plans can be developed as stand-alone documents or they can be developed as components of larger community level planning efforts.

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

INTRODUCTION

This Delineation and Assessment Report was prepared by Jenny L. Erickson, a research assistant with the Montana Bureau of Mines and Geology, under the supervision of Jon Reiten, a Hydrogeologist with the Montana Bureau of Mines and Geology – Billings office. Jim Stimson, a Hydrogeologist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Program reviewed and edited this report. The Richland County Valley View WUA public water supply (PWS) is located in Richland County, Montana, about 50 miles northeast of Glendive and about 12 miles from the border of North Dakota ([Figure 1](#)). The DEQ PWS identification number, operator name, and operator number for the Richland County Valley View WUA PWS appear on the title page of this report.

Purpose

This report is intended to meet the technical requirements for the completion of the source water delineation and assessment report for the Richland County Valley View WUA 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 Montana Source Water Protection Program is intended to be a practical and cost-effective approach to the protection of public drinking water supplies from contamination. The primary purpose of this source water delineation and assessment report is to provide information to assist the Richland County Valley View WUA PWS operator in the identification of potential contaminant sources near and upstream from the Richland County Valley View WUA wells, and to encourage the development of a source water protection plan to help protect the Richland County Valley View WUA drinking water for the long term.

Delineation and assessment constitute major components of the Montana Source Water Protection Program. Delineation entails mapping the boundaries of source water protection areas, which encompass ground water and/or surface waters contributing to public water supply sources. Assessment involves identifying locations or regions within source water protection areas where contaminants may be generated, stored, transported, or disposed, and determining the relative susceptibility of drinking water to contamination from these sources.

Limitations

This report was prepared to assess threats to the Richland County Valley View WUA public water supply and is based on published data including the most recent sanitary survey, and information obtained from local residents familiar with the community. The terms “drinking water supply” and “drinking water source” refer specifically to the sources of Richland County Valley View WUA public water supply, and not any other public or private water supply. Also, not all of the potential or existing sources of ground water or surface-water contamination in the area of Richland County Valley View WUA are identified. Only potential sources of contamination in areas that contribute water to the identified drinking water sources are considered.

The term “contaminant” is used in this report to refer to constituents for which maximum concentration levels (MCLs) have been specified under the national primary drinking water standards, and to certain carcinogenic or toxic constituents that do not have MCLs but are considered to be significant health threats.

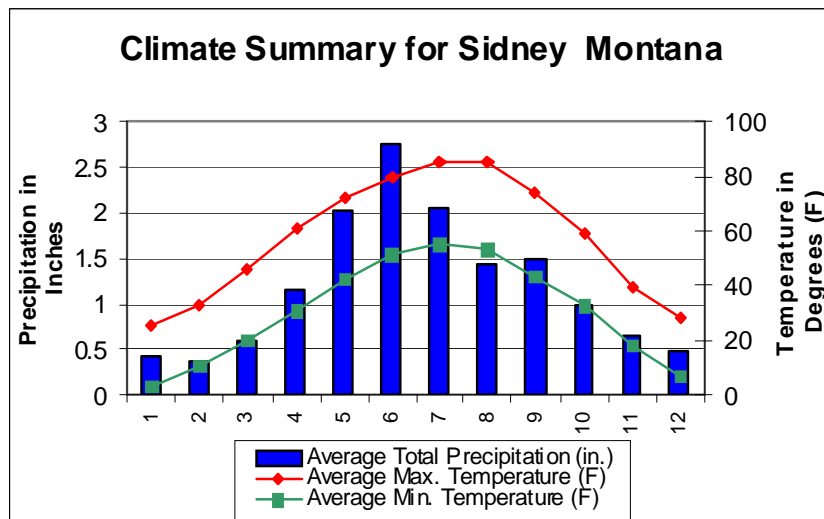
CHAPTER 1 - BACKGROUND

The Community

Richland County Valley View WUA is a subdivision that is located approximately 16 miles south east of the town of Sidney in Richland County. The Richland County Valley View WUA of Sidney is located in east-central Montana and lies on the west side of the Yellowstone River and it is a community system that uses ground water as their source of water (Figure 1 and Figure 3). State Highway 16 / 200 and the Northern Pacific/Burlington Northern Railroad run through the town of Sidney. The U.S. Census Bureau estimates the 2000 population of Richland County at 10,716 people, 4,829 of whom reside in Sidney. The population of Sidney is currently about 5,700. The Yellowstone River flows generally northeast through this part of Montana, to the confluence of the Missouri. The valley formed by the Yellowstone River is about 3 to 6 miles wide near Sidney.

Within the Sidney city limits, residents obtain their drinking water from the municipal public water supply. The municipal sewer district services all residents within the city limits and some areas outside the city limits. A wastewater treatment plant also serves the city with multi-celled lagoons located about one mile southeast of town. Residents in areas outlying town limits where sewer services are not available utilize on-site septic systems for waste disposal.

Figure 2. Average Temperatures and Precipitation



Climate

Based on Western Regional Climatic Center data for the period of record, annual precipitation averages 14.38 inches (Table 1). Monthly average precipitation ranges from 0.38 inches in February to 2.76 inches in June. Summer thunderstorms and winter snows provide a majority of the precipitation in the area. The annual mean snowfall in Sidney is 34.58 inches. A summary of the available climatic data for the Sidney area is presented in Table 2 below.

SIDNEY, MONTANA (247560)													
1971-2000 Monthly Climate Summary													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	24.9	33.1	45.8	60.5	72.1	80.1	85.5	84.7	73.5	59.5	39.3	28	57.4
Average Min. Temperature (F)	3.4	10.5	20.3	30.7	42.3	51	54.8	53.1	43.1	32.2	18.2	7.1	30.7
Average Total Precipitation (in.)	0.42	0.38	0.58	1.14	2.02	2.76	2.05	1.42	1.49	1	0.65	0.48	14.38

Table 2. Climate Summary.

Western Regional Climate Center, wrcc@dri.edu

Geographic Setting

Richland County Valley View WUA is located in the glaciated portion of the Great Plains physiographic province of North America (Rocky Mountain Association of Geologists, 1972). This area is also designated as the glaciated central ground water region of the United States (Heath, 1984). Early Wisconsin glacial drift and related sedimentary deposits are shown to extend in the Yellowstone Valley south west of the town of Sidney and terminate near the town of Intake (Howard, 1960). The elevation at Richland County Valley View WUA is approximately 2,000 feet above mean sea level and the subdivision is located approximately 1 mile south east of the Yellowstone River (Figure 3). Topographic relief in the area is low with highlands rising about 200 to 400 feet above the river valley. Many of the creeks and tributaries to the Yellowstone have moderately incised channels.

Geology

This section provides an overview of the geology and hydrology of the vicinity of Richland County Valley View WUA. Reports used for this section include Reiten (1998), Smith et al. (2000), Slagle et al (1984), Stoner and Lewis, (1980), Howard, A. D., 1960, Torrey, A. E., and Swenson, F. A., 1951. The geology of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers. An understanding of hydrogeologic conditions also provides an explanation for the sensitivity of local aquifers to potential contamination sources.

The Richland County Valley View WUA water supply consists of two deep wells (>1,000 feet) producing from the Fox Hills- Hell Creek Formations (Figure 2 and 4). This geologic formation is made up of silty shale, mudstone, fine and medium grained sandstones, and few thin coals. The Hell Creek contains less sandstone and coal and more mudstone than the overlying Fort Union Formation.

Due to the fact that Richland County Valley View WUA obtains its drinking water from a confined bedrock aquifer, the source water is classified as low source water sensitivity to contamination, in accordance with Montana Source Water Protection Program criteria (1999), also see Table 3 below.

The Public Water Supply

The Richland County Valley View WUA PWS is classified as a community system under the Federal Safe Drinking Water Act, because the system serves at least 25 year-round residents through at least 15 service connections. The PWS has 38 service connections, approximately 28 active connections, and a resident population of 120 people.

The most recent sanitary survey was conducted on May 31st, 2001 by Mr. Tim Hunter with HDR Engineering under contract with the DEQ. A copy of this survey is included in Appendix C of this report. Richland County Valley View WUA is served

by two wells. The well logs for these wells are included in Appendix A. These public water supply wells are listed in GWIC under the name Raymond Thiel Jr.; not Richland County Valley View WUA. Well #1 is a secondary, backup well that is located next to the pump house (Figure 1). The well is 1,431 feet deep and was drilled in 1976 by Gulbraa Drilling. It has an eight-inch casing at the surface that extends 30 inches above the ground. The cap has a vent that is constructed of PVC pipe with a screen. There is a pellet chlorinator that is mounted on this wellhead that deposits chlorine tablets into the well each time the pump turns on. The flow switch is located inside the pump house. The well has a five horsepower (hp) submersible pump. This well pumps out of a formation that is high in fluoride. The users of this water system use it for bathing and dishes, and use bottled water for consumption. Well #2 is located in a draw approximately 1/2 mile north of well #1 and is the primary source of water to the public water supply system (Figure 1). This well is 1,344 feet deep and was drilled in 1977 by Boyce Drilling. It was lined and grouted in 1986 to eliminate color in the water according to Fred Boyce of Boyce Drilling. It has a wire livestock fence around the wellhead. There is a frost-proof hydrant near the wellhead that supplies water to a stock watering tank nearby. The wellhead has an eight-inch casing at the surface extending 48 inches above the ground. It has a metal cap with unsealed wires passing through the cap. The cap does not have a vent. The well has a five hp submersible pump.

The submersible pumps located in the wellheads pump to a 12,000-gallon fiberglass storage tank that is located in the pump house. The upper 1/3 portion of the tank extends above the roof of the pump house with the bottom 2/3 inside the pump house. A combined vent/overflow pipe extends out of the top of the storage tank and angles down and away from the pump house. The end of this pipe is located on the ground about 25 feet from the pump house. A screen is provided from the end of the pipe, but was not in place at the time of inspection in 2001. The pipe had also become separated at one of the joints coming off the roof of the pump house. Full-time disinfection consists of a pellet chlorinator on the south well (well #1) and liquid Sodium Hypochlorite on the discharge from the north well (well #2). Household bleach is used for hypochlorination system in the 1,200-gallon storage tank.

Two Baldor 5 hp centrifugal pumps transfer the water from the storage tank to a 3,000 gallon galvanized steel pressure tank which is also located inside the pump house. A small, tank-mounted, air compressor supplies air for the pressure tank. As water is used in the distribution system, pressure switches control the transfer of water from the storage tank to the pressure tank. Mercoid switches control the submersible pumps in the wells to maintain the water level in the storage tank. The piping that supplies the

Table 3. Source water sensitivity criteria
<p>High Source Water Sensitivity Surface water and GWUDISW Unconsolidated Alluvium (unconfined) Fluvial-Glacial Gravel Terrace and Pediment Gravel Shallow Fractured or Carbonate Bedrock</p>
<p>Moderate Source Water Sensitivity Semi-consolidated Valley Fill Sediments Unconsolidated Alluvium (semi-confined)</p>
<p>Low Source Water Sensitivity Consolidated Sandstone Bedrock Deep Fractured or Carbonate Bedrock Semi-consolidated Valley Fill Sediments (confined)</p>

distribution system is PVC. In April, 2002, an operation and maintenance technical assistance visit was made by Tim Miller with the Midwest Assistance Program. According to this report, the following observations and assistance were made:

The following recommendations were made for the Richland County Valley View WUA system in the sanitary survey:

- 1. North Well Location:** This is in a wet, boggy area that was surrounded by cow manure and a dead cow. These conditions are not acceptable for maintaining a sanitary water supply. The fence should be moved to protect a larger perimeter around the well head from livestock. The stock watering tank should also be moved away.
- 2. Cross-contamination Hazard:** The frost-proof hydrant by the north well that supplies the stock watering tank could present a cross contamination hazard to the well. The hose connecting the stock watering tank should be eliminated and a back-flow preventer in the form of an air gap between the water system and the stock tank should be provided.
- 3. Storage Tank Overflow Pipe:** The overflow pipe needs to be reconnected where the pipe has separated at the pump house.
- 4. Fluoride:** The system needs to continue to work on options to reduce the fluoride in the water supply.
- 5. Meters:** The flow meters on the system should be operational so water consumption and well production can be monitored.
- 6. Well Cap:** The north well cap should be sealed where the wires pass through. It should also be provided with an inverted and screened vent.
- 7. Chlorine Monitoring:** The chlorine residual monitoring for this system is inadequate. Section 17.38.225 of the administrative rules of Montana require that water systems that employ full-time disinfection perform at least two chlorine residual tests each day; one at the application point and one in the distribution system. The results must be documented and reported to the DEQ.
- 8. Monitoring:** Except for the chlorine residual monitoring, the monitoring history for this system is adequate. A copy of the DEQ circular *Summary of Drinking Water Regulations for Community Water Supplies* was left with the operator of this system.

It is not know if these recommendations were implemented by the subdivision.

Richland County Valley View WUA PWS Water Quality

Public water systems must conduct routine monitoring for contaminants in accordance with Federal Safe Drinking Water Act requirements. A community public water supply, like Richland County Valley View WUA, must sample in accordance with schedules specified in the Administrative Rules of Montana (ARM). Monitoring includes coliform bacteria, lead, copper, nitrate, nitrite, volatile organic chemicals (including hydrocarbons and chlorinated solvents), inorganic chemicals (including metals), synthetic organic chemicals (including pesticides), and radiological contaminants. Transient, non-community

PWSs are required to conduct routine monitoring only for pathogens (including coliform bacteria), nitrate, and nitrite. All contaminant concentrations detected in required samples must comply with numeric maximum contaminant levels (MCLs) specified in the Federal Safe Drinking Water Act.

According to the U.S. EPA Safe Drinking Water Information System (SWDIS) database, nine significant health-based violations have been reported in the last five years (See Appendix B). Eight of these violations have been reported for the contaminant Fluoride exceeding the safety standard MCL (Maximum Contaminant Level). Levels of Fluoride found were from 5.3 to 5. One violation was found for the contaminant Coliform in February 2003. Significant monitoring and reporting violations were found for Coliform in October 2002, August 2002, and June 2002. Additional significant monitoring and reporting violations were found for a CCR (Consumer Confidence Rule) Complete Failure to Report in July 2002 and July 2000 (EPA SWDIS, 2005). The water quality results for this public water supply are included in Appendix B.

CHAPTER 2 DELINEATION

The source water protection areas for the Richland County Valley View WUA public water system are delineated in this chapter. The purpose of delineation is to map the land areas that contribute water to the aquifer used by Richland County Valley View WUA public water supply and to define areas that help prioritize source water protection efforts. The management areas identified within the larger source water protection area included the control zone, inventory region and recharge region. The control zone is a fixed radius of 100-feet around the well. The management goal of the control zone, also known as the exclusion zone, is to protect against the direct introduction of contaminants into the wells or in the immediate area surrounding each well. The inventory region represents the zone of contribution of the well and is a fixed radius of 1,000 feet around the well. The management goal of the inventory region is to focus on pollution prevention activities at potential contaminant sources where it is likely that contaminated water would flow into the wells within a relatively short time-frame. The recharge region represents the entire portion of the aquifer that contributes water to the Richland County Valley View WUA water system. Management in the recharge region should focus on maintaining and improving the quality of ground water that could reach each well over longer timeframes or with increased water usage.

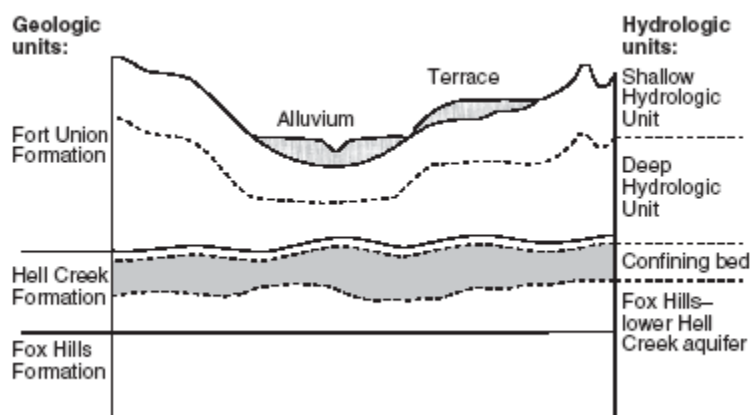
General Hydrogeologic Setting

Aquifers in this region have been grouped together based on their depth from the land surface. The groups are referred to as hydrologic units. The shallow hydrologic unit represents aquifers within 200 feet of the land surface (Slagle et al. 1983, Smith et al. 2000). In most places this includes aquifers within the alluvium and terrace deposits, and sandstones in the upper part of the Fort Union Formation. Ground water flow within this shallow hydrologic unit is generally from upland areas toward local stream tributaries and major streams. Recharge to the shallow hydrologic unit comes primarily from infiltration of precipitation; to a lesser extent recharge also comes from water losses from some stream channels, irrigation ditches, and return flows from irrigated fields (Smith et al., 2000). Below 200 feet, a deeper hydrologic unit is present above the claystone and shale beds in the upper Hell Creek Formation. Ground water flow within the deep hydrologic unit is from upland areas toward major streams and is generally thought to bypass or flow beneath local tributary valleys. Recharge areas for the deep hydrologic unit comes from near the Sheep Mountains in northern Prairie County and areas in southeastern Fallon County. Sandstones in the Lower Hell Creek - Upper Fox Hills represent a third hydrologic unit in this region. The Colgate Member of the Fox Hills is an important drilling target in this hydrologic unit (Smith et al, 2000). Ground water flow in the Lower Hell Creek - Upper Fox Hills is generally toward major streams including the Yellowstone and Missouri rivers. Recharge appears to come some distance from upland areas east of the Richland County Valley View WUA area (Smith et al. 2000). Aquifer and non-aquifer materials that form three definable hydrologic units occur within this geologic framework. The units, shown schematically in Figure 2, are as follows:

- A Shallow Hydrologic Unit: aquifers and non-aquifers within 200 feet of the land surface;
- A Deep Hydrologic Unit: aquifers and non-aquifers that occur at depths greater than 200 feet below land surface but lie stratigraphically above the regionally extensive claystone and shale in the upper Hell Creek Formation;
- The Fox Hills–Lower Hell Creek aquifer: near-continuous sandstone deposits found in the

lower part of the Hell Creek Formation and in most of the Fox Hills Formation.

Figure 2. Generalized cross section that shows relationships between geologic and hydrologic units. Names of the hydrologic units only partly reflect the names of the associated geologic units.



In the Deep Hydrologic Unit, intermediate to regional flow patterns characterize ground water movement. The potentiometric surface of the Deep Hydrologic Unit is a subdued representation of the topography; the highest ground water altitudes coincide with the regional topographic highs and the lowest altitudes with the regional topographic lows. Ground water flow is predominately away from major drainage divides, such as the Big Sheep Mountain area in northern Prairie County and toward the Yellowstone and Missouri rivers. Downward leakage from the Shallow Hydrologic Unit and higher pressured leakage from the Fox Hills–Lower Hell Creek aquifer recharge the Deep Hydrologic Unit. Prominent surface recharge areas are northern Prairie County (near Big Sheep Mountain) and southeast Fallon County where the potentiometric surface is more than 3,000 feet above sea level. Upward flow from the Fox Hills–Lower Hell Creek aquifer recharges the Deep Hydrologic Unit in topographically low areas. Discharge areas coincide with the major stream valleys, such as along the Yellowstone and Missouri rivers (Smith et al., 2000).

The Fox Hills–Lower Hell Creek aquifer occurs at depths of 600 to 1,600 feet below land surface, except near the Cedar Creek Anticline and the Poplar Dome. Mudstones in the Hell Creek Formation confine the top of the aquifer, and the Pierre Shale confines the base of the aquifer. Water levels, in wells completed in this aquifer, will rise above the top of the aquifer under artesian pressure, and in low areas—such as the Yellowstone River valley—flowing wells are common. Under most of this area, ground water in the aquifer is flowing regionally from upland recharge areas south of the study area toward the Yellowstone River; the flow is basically parallel to the axis of the Cedar Creek Anticline. In the northern part of this area, the regional flow is toward the Missouri River. Outcrops on the southwest side of the Cedar Creek Anticline, where the aquifer is exposed at land surface, do not appear to be significant sources of recharge. The wider exposures of the aquifer on the east side of the anticline may result in some recharge. This conclusion is suggested by the potentiometric surface sloping to the north, away from the northeast flank of the anticline. In topographically high areas, recharge also occurs by slow downward leakage from overlying aquifers through the confining mudstones of the Hell Creek Formation. Ground water discharges from the aquifer to wells and in topographically lower areas, by upward leakage to shallower aquifers and streams (Smith et al, 2000).

Local Hydrogeological Setting

The Richland County Valley View WUA is served by two wells completed in the Fox Hills-Lower Hell Creek aquifer. This aquifer consists of consolidated bedrock and sandstone deposits and is considered a confined aquifer. The primary well (Well #2) flows by natural artesian pressure which is representative of the majority of wells completed in this aquifer. Ground water flow is generally northwest towards the Yellowstone River (Figure 3).

Conceptual Model and Assumptions

Source water for the Richland County Valley View WUA public water supply comes from consolidated bedrock (Appendix A & Table 4). The aquifer is considered tightly confined and recharge is assumed to come from land areas generally southeast of Richland County Valley View WUA.

Source Well

Two wells are used to supply water for the Richland County Valley View WUA public water supply. Table 4 below summarizes well data for the Richland County Valley View WUA wells.

Table 4. Richland County Valley View WUA wells #1 and #2.

MBMG # DNRCWR#	35866 17023 Well #1	35867 Unknown Well #2
Location	22N 59E 14 AC	22N 59E 14 BABD
Date Completed	9/2/1976	9/7/1977
Depth (ft bgs*)	1431	1345
Screened Interval (ft**)	1382-1431	1220-1344
SWL Depth (ft bgs*)	28	Flowing
PWL Depth (ft bgs*)	124	Unknown
Drawdown (ft**)	96	Unknown
Test Pumping Rate (gpm***)	24	Unknown
Specific Capacity Richland County Valley View WUA (gpm/ft****)	0.250	Unknown

*ft bgs = feet below ground surface, **ft = feet, ***gpm = gallons per minute, ****gpm/ft = gallons per minute per foot of drawdown.

Delineation Results

Control Zones

The control zones for the Richland County Valley View WUA wells consist of a 100-foot fixed radius circle, in accordance with the criteria specified in the Source Water Protection Program Document (1999). All potential sources of contamination are inventoried within the control zone.

Inventory Region

A source water protection area for the Richland County Valley View WUA wells consist of a 1,000 foot fixed radius circle.

Recharge Region

The Watershed Region for the Richland County Valley View WUA intake encompasses the land area within the Lower Yellowstone Watershed (Eighth Code: 10100004) (Figure 7). The recharge region shown in Figures 6 and 7 has been modified to represent the assumed recharge for the source water of the Richland County Valley View WUA public water supply within this watershed. The recharge region contains only the area up-gradient of the Richland County Valley View WUA public water supply and is bounded to the north and east by the Bennie Peer Creek (Figure 7). This region also is assumed to include recharge from across the North Dakota state line border. General land uses and large potential contaminant sources are inventoried in the recharge region.

Limiting Factors

The reader needs to recognize that the inventory region delineation for the Richland County Valley View WUA PWS wells represents an approximation of the distance required for up-gradient ground water to reach the wells. Due to the relatively limited data available on the PWS wells and the hydraulic properties of the aquifer, large uncertainties are associated with estimates of hydraulic conductivity, porosity, aquifer thickness, aquifer extent, hydraulic gradient, and hydraulic boundaries

CHAPTER 3 INVENTORY

An inventory of potential sources of contamination was conducted to assess the susceptibility of the Richland County Valley View WUA PWS to contamination, and to identify priorities for source water protection planning. Inventories were conducted within the control zones, combined inventory and recharge regions. The inventory focuses on facilities that generate, use, store, transport, or dispose of potential contaminants, and on land types on which potential contaminants are generated, used, stored, transported, or disposed. Additionally, the inventory identifies potential sources of all primary drinking water contaminants. The inventory focuses on land areas within the inventory region and a watershed south and east of Richland County Valley View WUA ([Figure 3](#) and [Figure 7](#)).

Inventory Method

Available databases were initially searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. The following steps were followed:

Step 1: Land cover is identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and U.S. Environmental Protection Agency (U.S.G.S., 2005). Land cover types in this dataset were mapped from satellite imagery at 30-meter resolution using a variety of supporting information.

Step 2: EPA's Envirofacts System was queried to identify EPA regulated facilities. This system accesses the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), Permit Compliance System (PCS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility is a significant potential contaminant source.

Step 3: DEQ databases were queried to identify Underground Storage Tanks (UST), hazardous waste contaminated sites, landfills, and abandoned mines.

Step 4: A business phone directory was consulted to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by Standard Industrial Codes.

Step 5: Major road and rail transportation routes were identified.

Step 6: All significant potential contaminant sources were identified in the inventory region and land uses and facilities that generate, store, transport, or dispose large quantities of hazardous materials were identified within the recharge region.

Potential contaminant sources are designated as significant if they fall into one of the following categories:

- 1) Large quantity hazardous waste generators
- 2) Landfills
- 3) Hazardous waste contaminated sites
- 4) Underground storage tanks
- 5) Major roads or rail transportation routes
- 6) Cultivated cropland
- 7) Animal feeding operations
- 8) Wastewater lagoons or spray irrigation
- 9) Septic systems
- 10) Sewered residential areas
- 11) Storm sewer outflows
- 12) Floor drains, sumps, or dry wells
- 13) Abandoned or active mines

Inventory Results/Control Zones

Control zone for the primary well (Well 2) appears to be located on an undeveloped lot with no potential contaminant sources present. The control zone for the backup well (Well 1) includes portions a developed lot, a subdivision street, and undeveloped lots. Potential contaminant sources for Well 2 may include: fertilizer and herbicide application lawns near the wells and infiltration of septic effluent.

Inventory Results/Inventory Region

Table 5 summarizes the significant potential contaminant sources that are located within the inventory region. This region includes developed and relatively undeveloped areas on the east side of Richland County Valley View WUA as well as some agricultural land and grassland ([Figure 3](#) and [Figure 6](#)). There are no underground known underground storage fuel tanks in the inventory region. There are no landfills or animal feeding operations in the inventory region. Some potential contaminant sources are on-site septic systems and surrounding septic density. The inventory region consists of 100% low septic density.

Land use in the inventory region includes grassland (52%), shrubland (24%), agricultural land (24%), and less than 1% bare rock/sand/clay ([Figure 6](#) and Table 10). Agricultural land is considered to be a significant potential contaminant source. Over application of fertilizers and/or pesticides can result in those ag-chemicals infiltrating into ground water and running off in to surface water bodies that may have hydraulic connection with aquifers that supply water. The percentage of ag-land in the inventory region is assigned a moderate hazard rating in accordance with the Source Water Protection Program guidelines.

Significant potential contaminant sources in the inventory region include: on-site septic systems and agricultural land ([Figure 3](#) and [Figure 6](#), Table 5). Many of the non-significant potential contaminant point sources in the Richland County Valley View WUA are located in town and west of the inventory region ([Figure 3](#)). These potential contaminant sources are considered to be cross and down-gradient from the Richland County Valley View WUA wells and do not pose a threat to the source water.

Table 5. Significant potential contaminant sources in the Inventory Region for Richland County Valley View WUA.

Potential Source	ID Number On Maps	Hazard
On-site residential septic systems	Not Numbered	Infiltration into ground water
Cultivated Cropland (24 % of the inventory region).	Not Numbered	Spills, over application, surface runoff

From the above list of potential contaminant sources, some are considered significant based upon the following factors: the volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or ground water, and the proximity of the sources to the PWS surface water intakes. Significant potential contaminant sources from the above list are discussed individually in the following section on susceptibility assessment and they are listed in Table 7.

Inventory Results/Recharge Region

Table 6 summarizes the significant potential contaminant sources that are located within the recharge region ([Figure 7](#)). Potential contaminant sources include: abandoned mine sites, primarily small gravel pits, and State Highway 23. While an oil pipeline is shown on the topographical map of the area, it does not show up in the environmental datasets available for the Montana NRIS website. A state superfund site is located about ¼ to ½ mile east of the subdivision.

The Sidney Wastewater Treatment Plant is appears to be located over a mile north and down-gradient from the public water supply wells, and does not pose a threat to the public water supply. An abandoned mine is located northwest and down-gradient of the inventory region, and does not pose a threat to the public water supply. The state superfund site is located in Lot 1 of the Richland County Valley View WUA Subdivision. This was the Rau disposal site for oil field wastes and was operated from 1985 to 1989. A remediation response and site cleanup was completed in July 1991. An oil pipeline is located southeast and up-gradient of the Richland County Valley View WUA but it appears to be over 1,000 feet away form the subdivision’s wells and outside of the inventory region. Highway 23 is a major transportation route located within the inventory region ([Figure 3](#)).

Predominant land covers in the Recharge Region include grassland (69%), shrubland (24%), cropped agriculture land (6%) and bare rock/sand/clay (1%). Forest, open water and woody wetlands are each less than 1% of land use in the Recharge Region ([Figure 7](#) and Table 11). Activities on agricultural land are considered be a significant potential contaminant source within the watershed region. The concern here is that mismanagement or over application of fertilizers and/or pesticides can result in those ag-chemicals infiltrating into ground water and running off in to surface water bodies that may be in hydraulic connection with aquifers used for water supplies. Due to the portion of the watershed region over which fertilizers and/or pesticides may be applied, the ag-chemicals are considered a potential threat to the Richland County Valley View WUA PWS.

Most of the significant potential contaminant point sources in the recharge region are located southeast of the Richland County Valley View WUA wells ([Figure 7](#)). These potential contaminant sources are considered to be up-gradient from the wells of Richland County Valley View WUA and could pose a threat to the source water. Low septic densities occur over the largest portion of the recharge region.

Table 6. Significant potential contaminant sources in the Recharge Region for Richland County Valley View WUA PWS.

Potential Source	ID Number on Maps	Potential Contaminants	Hazard
Waste Water Treatment Lagoon	4	VOCs, SOCs, metals, pathogens, nitrates, others	Ongoing or catastrophic leakage of sewage into ground water
Cultivated Cropland	Not Numbered	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff
State Superfund Site	1	Various	On-site soil contamination
Petroleum Pipeline	3	Fuels, hydrocarbons	Spills, leaks and releases
State Highway 23	2	Pesticides, fertilizers, VOCs, other	Spills, routine spraying, storm water runoff, infiltration into ground water.

From the above list of potential contaminant sources, some are considered significant based upon the following factors: volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or ground water, and the proximity of the sources to the Richland County Valley View WUA wells.

Inventory Update

To make this SWDAR a useful document in the years to come, the owners, manager, or the certified water system operator(s) for the public water supply should update the inventory for their records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ at least every 5 years to ensure that this report/plan stays current in the public record.

Inventory Limitations

The extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data readily available through state documents, published reports, and other public sources. Documentation may not be readily available on some potential sources. As a result, all potential contaminant sources may not have been identified. In some instances, inadequate location information precluded the inclusion of potential sources in the inventory.

CHAPTER 4 SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the owner of Richland County Valley View WUA and Richland county.

The goal of source water management is to protect 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 land use activities in the watershed region pose minimal threats to the source water. Management priorities in the inventory region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the Richland County Valley View WUA PWS operators, Richland County Valley View WUA, and county officials to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the PWS well(s) (Tables 7 and 8). For point sources, hazard is rated by the proximity of a potential contaminant source to the well(s). A high hazard rating is assigned to point sources if the PWS well is not sealed through the confining layer. A moderate hazard rating is assigned to point sources if wells in the inventory region other than the PWS well are not sealed through the confining layer. A low hazard rating is assigned to point sources if all wells in the inventory region are sealed through the confining layer. Hazard ratings for non-point sources are assigned based on the following criteria in Table 7.

Table 7. Hazard of potential contaminant sources for the Richland County Valley View WUA public water system wells.

	PWS well is not sealed through the confining layer	Well(s) in the inventory region other than the PWS well are not sealed through the confining layer	All wells in the inventory region are sealed through the confining layer
Point Sources	High	Moderate	Low
Septic Systems (# per sq mile)	High: > 300 Moderate: 50 – 300 Low: < 50	Moderate: > 300 Low: < 300	Low
Sanitary Sewer (% land use)	High: > 50 Moderate: 20 – 50 Low: < 20	Moderate: > 50 Low: < 50	Low
Cropland (% land use)	High: > 50 Moderate: 20 – 50 Low: < 20	Moderate: > 50 Low: < 50	Low

Barriers to contamination can be anything that decreases the likelihood that contaminants will reach a spring or well. Barriers can be engineered structures, management actions, or natural conditions. Examples of engineered barriers are spill-catchment structures for industrial facilities and leak detection for underground storage tanks. Emergency planning and best management practices are

considered management barriers. Thick clay-rich soils, a deep water table or a thick saturated zone above the well intake can be natural barriers. Table 8 shows how barriers are used to adjust the final susceptibility ratings.

Table 8. Susceptibility of Source Water based on Hazard rating and the presence of Barriers

	High Hazard Rating	Moderate Hazard Rating	Low Hazard Rating
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant on the following page (Table 9).

Susceptibility Assessment Results

Table 9. Susceptibility Assessment Of Significant Potential Contaminant Sources in the Inventory and Recharge Regions Of Richland County Valley View WUA PWS.

Inventory Region							
Source	ID Number on Maps	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Cultivated Cropland (24% in the inventory region) (6% in the recharge region)	Not Numbered	Fertilizers, pesticides, pathogens, nitrate	Spills, over-application, surface runoff	Moderate Low	--Depth to Screened Interval (> 100 feet) --Distance from well field (most of the ag-land is in the mid- to upper portion of the watershed)	Low Very Low	Support efforts to provide educational information, materials and resources to land owners on the proper application and storage of pesticide and fertilizers; implement agricultural BMPs
Wastewater treatment facilities (lagoons), sludge handling sites, or land application areas	4	VOCs, SOCs, metals, pathogens, nitrates, others	Ongoing or catastrophic leakage of sewage into groundwater	Low	--Down-gradient from wells --Depth to Screened Interval (> 100 feet)	Very Low	Review permit status (contact DEQ Permitting and Compliance Water Protection Bureau – 406-444-3080 for more information) and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention and BMPs

Recharge Region							
Source	ID Number on Maps	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
State Highway 23	2	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water.	Low	--Depth to Screened Interval (> 100 feet) -Local and state emergency response -Not a major truck route	Very Low	Maintain vigilant for accidents involving large vehicles Maintain emergency response plan and support training and preparation of local response personnel
On-Site Residential Septic Systems 100% Low Septic Density	Not Numbered	Nitrate, pathogens	Leaks in septic tanks, leaks in collection lines, system failure	Low	--Depth to Screened Interval (>100 feet) -Continuous Clay Layer	Very Low	Properly operate and maintain the on-site septic system and distribution lines. A two to three year septic tank pumping maintenance schedule is recommended. Consider connecting to municipal sewer system, if available Encourage and support city and county efforts to extend city sewer or to promote installation of community or advanced treatment septic systems and regular maintenance of septic tanks and distribution lines.
State and Federal Cleanup Sites (known soil or groundwater contamination)	1	Various	Contaminants leaching into groundwater	Low	--Depth to Screened Interval (> 100 feet) --On-going remediation and monitoring --Groundwater monitoring	Very Low	Contact DEQ's Remediation Division (406-841-5000) to review status and any permits or monitoring network to verify existing contamination is being properly removed or remediated.
Petroleum Pipeline	3	Fuels, hydrocarbons	Spills, leaks and releases	Low	--Depth to Screened Interval (>100 feet) -County Emergency Response Plan	Very Low	Maintain preparedness of local emergency personnel through active training, storm water diversion

Recharge Region							
Source	ID Number on Maps	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Abandoned or Active Mines	Not numbered	Metals and petroleum products or VOCs from equipment	Spills and leaks impacting groundwater	Low	--No active mine sites are present. --Depth to Screened Interval (>100 feet)	Very Low	For active mines, contact DEQ's Industrial and Energy Minerals Bureau (406-444-4970) to review status and any permits or monitoring network. For closed or abandoned mines, contact DEQ's Remediation Division (406-841-5000) to review status and any permits or monitoring network to verify existing contamination is being properly removed or remediated.bandoned or Active Mines
Class V Injection Wells	Not Numbered	VOCs, SOCs, pathogens, nitrate	Infiltration of contaminants into aquifer	Unknown	--Unknown	Not determined	Encourage EPA to inventory the area Support providing educational information, materials and resources to business owners and the public on proper waste disposal and recycling

Notes: VOCs - Volatile organic compounds (i.e. solvents, fuel components) SOCs - Synthetic Organic Compounds (i.e. pesticides, herbicides, plasticizers)
 UST - Underground Storage Tank LUST - Leaking Underground Storage Tank
 BMPs - Best Management Practices DEQ- Montana Department of Environmental Quality
 RR - Recharge Region SIC - Standard Industrial Code

The susceptibility assessment results for each significant potential contaminant source identified are described below:

Cultivated Crop lands – The potential hazard from pathogens and nitrate originating from agricultural lands is rated as moderate based on the percentage of ag-land in the inventory region. The susceptibility is rated as low with multiple barriers applied. Within the Recharge region, hazard is rated as low with multiple barriers applied resulting in a very low susceptibility.

Highway- State Highway 23 passes through the recharge region. Accidents on the highway could result in a variety of hazardous materials spilled on or along the highway. Susceptibility is rated as very low due to multiple barriers applied.

Wastewater Discharges- The potential hazard from VOCs, SOCs, pathogens, and nitrate originating from wastewater discharges is low because the discharge sites are either a significant distance from the Richland County Valley View WUA wells or they are down-gradient from the wells. Susceptibility is rated as very low due to multiple barriers applied.

Mining Operations- Based on available information, the mining operations in the area are relatively small and simply represent sand and gravel operations. They are assigned a low hazard and very low susceptibility. However, it is important to understand that gravel pits are essentially large openings into the shallow ground water system and if hazardous materials are accidentally or illegally dumped into the pits the results can be serious. It is always advisable to restrict access to abandoned sand and gravel pits, especially those located up-gradient from water supply wells.

Management Recommendations

It should be noted that even small releases of some chemicals in close proximity to a well can have significant negative impact on water quality, and is therefore a significant threat to the public water supply. Steps can be taken to reduce the likelihood of releases in the source water for the PWS or in the vicinity of the sources. Some of these steps (considered management recommendations) are listed below.

Some management recommendations are also included in the susceptibility table for the Richland County Valley View WUA PWS (Table 9). If these, and other, management actions are implemented, they may be considered additional barriers that will reduce the susceptibility of the intake to specific sources and contaminants.

Management recommendations fall into the following categories:

- Sewer maintenance and leak detection
- Municipal sewer extension
- Agricultural best management practices
- Stormwater management

- Proper disposal and monitoring of oil and gas production wastewater
- Education
- Emergency Response Planning

Restrict Chemical Handling, Use and Storage in the Control Zone for the Well – The PWS should restrict chemical handling, use and storage within the 100’ radius Control Zone of the production well. Ongoing training should be provided to promote safe handling and proper storage, transport, use, and disposal of hazardous materials if these materials are used. Regular maintenance and inspections of the USTs, diesel generators, and concrete floors, should be conducted to protect the area from diesel or other chemical spills. Any USTs that are out of service should be removed and soils should be tested to evaluate potential impact from historic spills or leaks. Conduct tank and line integrity testing for active tanks and ensure proper operation and maintenance.

Sewer Maintenance and leak detection – Early warning of leaks and scheduled replacement of aging sewer lines may reduce the susceptibility of the Richland County Valley View WUA PWS to contamination from municipal septic wastes, and could also benefit other public water supplies in the Richland County Valley View WUA area.

Sewer Extension – Installation of advanced septic treatment systems such as sand filters can limit contamination from new rural residential development, however, annexation and extension of sewers is the only way to reduce contamination from existing unsewered developments.

Agricultural and silvicultural best management practices (BMPs) – BMPs that address application and mixing of fertilizer and pesticides are a viable alternative to prohibition of their use. BMPs may also be utilized to minimize surface runoff and soil erosion on cultivated fields. Erosion control, selective logging, and other silvicultural practices (essentially BMPs) should be considered on a county-wide basis. BMPs are generally voluntary but their implementation can be encouraged through education and technical assistance. County planning can help promote the implementation of BMP on lands that are outside the city limits but indirectly affect the Richland County Valley View WUA PWS.

Inactive USTs/LUSTs - It is recommended that the PWS operator or community members contact DEQ’s Waste and Underground Tank Management Bureau (406-444-5300) to obtain further information on the cleanup status and any permits or monitoring networks to verify existing contamination is being properly assessed and remediated. The PWS can work with DEQ to encourage proper abandonment for out-of-service tanks and soil testing to evaluate potential impact from historic spills or leaks.

Stormwater Management - Stormwater planning should address source and drainage control. Source control can be accomplished through educational programs focusing on residential and commercial chemical use, disposal, and recycling. Drainage control and pollutant removal can be accomplished through the use of vegetated retention basins at outfall locations.

Education - Educational workshops provided to the general public by the city of Sidney, county, or state to promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated emergency personnel will promote the efficiency and effectiveness of emergency responses to hazardous material spills. Likewise, educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. The EPA and the State of Montana can provide educational materials on these topics.

Hazardous Materials Collection Days – Several counties in the state that have vulnerable water supplies have implemented scheduled days for the collection of hazardous wastes from the public. These vary in the inclusiveness of what materials are collected, how the materials are handled, and how they are disposed of, but they all act to reduce the amount of unauthorized or improper disposal of these wastes. Used motor oil collection station could be established and available to the public on a regular basis.

Emergency Response Plan – Several counties have compiled Emergency Response Plans that were then adopted by the local communities. The usefulness and effectiveness of a response plan are maximized if it contains a clear listing of all emergency contacts, emergency numbers, and resources available within the county to respond to an emergency situation, such as a hazardous material spill. Emergency plans are not difficult to develop or distribute, but have a significant benefit to the citizens and municipalities within the county.

Drinking Water Protection Plan – The next phase of source water protection for the PWS would be for the water system owner/operator and the community to take the information presented in this source water delineation and assessment report and use it to continue development of a Drinking Water Protection Plan. The Drinking Water Protection Plan would clearly identify: 1) strategies to reduce the likelihood of contaminant releases within the inventory region, 2) the procedures to follow (emergency response plan) in the event that the PWS well becomes threatened by contaminants, and 3) identify alternate sources of drinking water.

CHAPTER 5

MONITORING WAIVERS

Waiver Recommendation

It appears that Richland County Valley View WUA does not currently have any water quality waivers except for the statewide waivers that are credited to all PWSs. Diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), polychlorinated biphenyls (PCBs), cyanide and asbestos (at the source) are excluded from monitoring requirements by statewide waivers. The PWS may be eligible for additional monitoring waivers. The water quality appears appropriate for waivers for Phase II inorganics (barium, cadmium, chromium, fluoride, mercury and selenium) and possibly Phase V inorganics (antimony, thallium, beryllium and nickel). Under this waiver, the monitoring schedule for these parameters could be reduced to every nine years, rather than every one or three years.

To be sure that eligibility for all available waivers is considered, the PWS Operators are encouraged to carefully review the following section on Monitoring Waiver Requirements. The PWS should demonstrate sufficient barriers such that the susceptibility would not change over the term of a compliance cycle, even with continued development in the area. The PWS must be in compliance with monitoring requirements to be considered. Written waiver requests must be sent to DEQ at the address below:

Greg Butts
Montana DEQ, PWS Section
109 Cooperative Way
Suite 105

KALISPELL, MT 59901

Upon receipt of a waiver request, DEQ will review the system's compliance history, historical monitoring results and source water setting. If waivers are considered appropriate, DEQ will provide the operator with application forms, guidance and technical assistance. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region. A site visit may be required to further investigate VOC and SOC use within the inventory region.

Monitoring Waiver Requirements

Use Waivers

A Use Waiver may be granted if it is determined that target organic chemicals were/are not used, manufactured, or stored in the area of a water source. 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 ground-water 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 ground water 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 ground-water flow and transport models. DEQ's PWS Section and 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 ground-water 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, ground-water 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 ground-water and area surface water, and physical parameters and dissolved constituents can be an indicator of the hydraulic connection between ground water 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 ground-water source must be defined and plotted. This should describe the ground-water 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.

REFERENCES

Alt, David, and Hyndman, Donald W., 1990, Roadside Geology of Montana, Mountain Press Publishing Company, Missoula.

DEQ Permitting and Compliance Division, 2001. Sanitary Survey for Richland County Valley View WUA PWS - PWS # 000644.

Heath, R. C., 1984, Ground water Regions of the United States, U.S. Geological Survey Water Supply Paper 2242, p. 78.

Howard, A. D., 1960, Cenozoic History of Northeastern Montana and Northwestern North Dakota with Emphasis on the Pleistocene. U.S. Geological Survey Professional Paper 326, 107p.

Montana Bureau of Mines and Geology well information, 2004:
<http://mbmgwic.mtech.edu/>

Montana State Library - Natural Resource Information Service, 2004.
<http://nris.state.mt.us/mapper/>

Montana State Library - Natural Resources Information System (NRIS) 2004 map base of the USGS Topographical coverage at 1:24,000 scale in MrSID format.

Slagle, S. E. et al., 1984, Hydrology of area 45, northern Great Plains and Rocky Mountain coal provinces, Montana and North Dakota: U.S. Geological Survey Water-Resources Investigations open-file Report 83-527, 90p.

Reiten, Jon, 1998, City of Sidney, Demonstration of Source Water Protection for a Public Water Supply using Ground water: Montana Source Water Protection Technical Guidance Manual Parts 1 and 2, Montana Department of Environmental Quality Publication, pp144-168.

Smith, L. N., LaFave, J. I., Patton, T.W., Rose, J. C., and McKenna, D. P., 2000, Ground water Resources of the Lower Yellowstone River Area: Dawson, Fallon, Prairie, Richland, and Wibaux Counties, Montana; Montana Ground water Assessment Atlas No. 1, Montana Bureau of Mines and Geology Publication, Part A and Part B-Map 7.

U. S. Environmental Protection Agency (US EPA), 1991. Manual of Small Public Water Supply Systems, US EPA Office of Water (WH-550), EPA 570/9-91-003.

Torrey, A. E., and Swenson, F. A., 1951, Ground water Resources of the Lower Yellowstone River Valley between Miles City and Sidney Montana; U.S. Geological Survey Circular 93.

U.S. Geological Survey, 2005. National Landcover Dataset, Montana. 30-meter electronic digital landcover / land use data set interpreted from satellite imagery.

Western Regional Climate Center, 2005. Climate Summary Data by Richland County Valley View WUA: <http://www.wrcc.dri.edu/summary/climsmmt.html>

GLOSSARY*

Acute Health Effect. An adverse health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Best Management Practices (BMPs). Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

Coliform Bacteria. Bacteria found in the intestinal tracts of animals. Their presence in water is an indicator of pollution and possible contamination by pathogens.

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 that inhibits the flow of water.

Delineation. A process of mapping source water management areas.

Effective Porosity. The percent of soil, sediment, or rock through which fluids, such as air or water, can pass. Effective porosity is always less than total porosity because fluids can not pass through all openings.

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

Hazard. A measure of the potential of a contaminant leaked from a facility to reach a public water supply source. Proximity or density of significant potential contaminant sources determines hazard.

Hydraulic Conductivity. A coefficient of proportionality describing the rate at which water can move through an aquifer.

Inventory Region. A source water management area that encompasses an area expected to contribute water to a public water supply well within a fixed distance or a specified ground water time-of-travel distance.

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.

Nitrate. An important plant nutrient and type of inorganic fertilizer. In water the major sources of nitrates are 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.

Pathogens. A bacterial organism or virus typically found in the intestinal tracts of mammals, capable of producing disease.

Point-Source. A stationary location or fixed facility from which pollutants are discharged.

Porosity. The percent of soil, sediment, or rock filled by air, water, or other fluid.

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

SIC Code. The U.S. Standard Industrial Classification (SIC) Codes classify categories of businesses. SIC Codes cover the entire range of business categories that exist within the economy.

Source Water Protection Area. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply.

Susceptibility (of a PWS). The 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. 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, non-point, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

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

Transmissivity. The ability of an aquifer to transmit water.

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

Volatile Organic Compounds (VOC). Any organic compound which evaporates readily to the atmosphere (e.g. fuels and solvents).

Recharge Region / Watershed. The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations and other sources.

FIGURES

[Figure 1.](#) General Location Map

Figure 2. Climate Summary- Imbedded in text on page 5

[Figure 3.](#) Inventory of Potential Contaminant Sources in the Richland County Valley

View WUA Area

[Figure 4.](#) General Geology Map

[Figure 5.](#) Inventory Region Map With Land Cover/Landuse

[Figure 6.](#) Recharge Region Map with Landcover/Landuse

[Figure 7.](#) Watershed Region Inventory Map

Table 10 & 11. Land Use Pie Charts for Inventory and Recharge Region

APPENDICIES

APPENDIX A - Well logs

PWS Well #1

Montana Bureau of Mines and Geology
Ground water Information Center Site Report
THIEL RAY JR

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

Location Information

GWIC Id: 35866 Location (TRS): 22N 59E 14 AC County (MT): RICHLAND DNRC Water Right: 17023 PWS Id: Block: Lot: Addition:	Source of Data: LOG Latitude (dd): 47.6698 Longitude (dd): -104.1070 Geomethod: TRS-TWN Datum: NAD27 Altitude (feet): 2150.00 Certificate of Survey: Type of Site: WELL
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Well Construction and Performance Data

Total Depth (ft): 1431.00 Static Water Level (ft): 28.00 Pumping Water Level (ft): 124.00 Yield (gpm): 32.00 Test Type: AIR Test Duration: 24.00 Drill Stem Setting (ft): Recovery Water Level (ft): Recovery Time (hrs): Well Notes:	How Drilled: FORWARD ROTARY Driller's Name: GULBRAA Driller License: WWC094 Completion Date (m/d/y): 9/2/1976 Special Conditions: Is Well Flowing?: Shut-In Pressure: Geology/Aquifer: 211FXHL Well/Water Use: DOMESTIC
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Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	101.0	8.0				STEEL
0.0	407.0	4.5				STEEL
407.0	1431.0	3.0				STEEL

Annular Seal Information

From	To	Description
41.0	1344.0	CEMENT

Completion Information¹

From	To	Dia	# of Openings	Size of Openings	Description
1382.0	1431.0	3.0			1\4 HOLE PERF

Lithology Information

From	To	Description
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0.0	42.0	YELLOW CLAY
42.0	82.0	BLUE CLAY
82.0	87.0	COAL
87.0	360.0	BLUE CLAY
360.0	395.0	SANDSTONE
395.0	1083.0	BLUE CLAY
1083.0	1084.0	ROCK
1084.0	1164.0	BROWN SHALE
1164.0	1167.0	ROCK
1167.0	1197.0	BROWN SHALE
1197.0	1279.0	GREY SHALE
1279.0	1292.0	SANDSTONE
1292.0	1295.0	ROCK
1295.0	1311.0	BROWN SHALE
1311.0	1322.0	BROWN SANDY SHALE
1322.0	1328.0	SANDSTONE
1328.0	1345.0	HARD BROWN SHALE
1345.0	1378.0	SANDSTONE
1378.0	1381.0	ROCK
1381.0	1391.0	SANDSTONE
1391.0	1392.0	ROCK
1392.0	1422.0	SANDSTONE
1422.0	1431.0	BROWN SHALE

PWS Well #2

Montana Bureau of Mines and Geology
Ground water Information Center Site Report
THIEL RAYMOND JR

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

Location Information

GWIC Id: 35867	Source of Data: LOG
Location (TRS): 22N 59E 14 BABD	Latitude (dd): 47.6730
County (MT): RICHLAND	Longitude (dd): -104.1125
DNRC Water Right:	Geomethod: UNKNOWN
PWS Id:	Datum: NAD27
Block:	Altitude (feet): 2040.00
Lot:	Certificate of Survey:
Addition:	Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 1345.00	How Drilled: FORWARD ROTARY
Static Water Level (ft):	Driller's Name: BOYCE
Pumping Water Level (ft):	Driller License: WWC274
Yield (gpm):	Completion Date (m/d/y): 9/7/1977
Test Type:	Special Conditions:
Test Duration:	Is Well Flowing?: YES
Drill Stem Setting (ft):	Shut-In Pressure: 0.47
Recovery Water Level (ft):	Geology/Aquifer: 211FHHC
Recovery Time (hrs):	Well/Water Use: DOMESTIC
Well Notes:	

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information¹

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	200.0	6.0				STEEL
189.0	1344.0	2.0				GALV PIPE

Annular Seal Information

From	To	Description
0.0	1200.0	NEAT CEMENT

Completion Information¹

From	To	Dia	# of Openings	Size of Openings	Description
1220.0	1344.0	2.0			1\4X4 SLOT PERF

Lithology Information

From	To	Description
0.0	18.0	BROWN SAND AND CLAY
18.0	20.0	SANDSTONE
20.0	35.0	BROWN SAND
35.0	38.0	COAL
38.0	160.0	GRAY CLAY

160.0	195.0	FINE GRAY SAND
195.0	295.0	GRAY CLAY
295.0	297.0	SANDSTONE
297.0	310.0	GRAY CLAY
310.0	335.0	COAL
335.0	410.0	GRAY CLAY
410.0	415.0	COAL
415.0	800.0	SANDY CLAY
800.0	840.0	FINE GRAY SAND
840.0	875.0	GRAY CLAY
875.0	880.0	COAL
880.0	1210.0	GRAY CLAY - LAYERS OF SANDSTONE
1210.0	1224.0	SAND
1224.0	1225.0	SANDSTONE
1225.0	1345.0	GRAY WATER SAND

APPENDIX B - Water Quality Report

APPENDIX C - Sanitation Survey

APPENDIX D - Concurrence Letter & Other Correspondence