ROOSVILLE BORDER STATION
PUBLIC WATER SYSTEM
SOURCE WATER DELINEATION AND ASSESSMENT REPORT

PWSID # MT0001143
Roosville
Lincoln County
Montana

NOVEMBER 18, 2005

PREPARED FOR:

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EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report was prepared under the Federal Safe Drinking Water Act and the Montana Source Water Assessment Plan. The Department of Environmental Quality (DEQ) is ensuring that assessments are completed for all public water systems in Montana. The purpose of these reports is to provide information so that the public water system operators, consumers, and community citizens can begin developing strategies to protect their source of drinking water. The information that is provided includes the identification of the areas most critical to maintaining safe drinking water, i.e., the inventory region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat these potential sources pose to the water system. Andrea Mazur, an intern with DEQ's Source Water Protection Program, completed this report, and it was reviewed by Eric Sivers, a DEQ hydrogeologist.

The drinking water for Roosville Border Station is supplied by one well that is located to the east of Well 1 (Well 1 is currently inactive and has been disconnected from the system) in front of the commercial check building. The well is completed in an unconfined aquifer. In accordance with the Montana Source Water Protection Program criteria (1999), the aquifer (source water) is considered to have a high sensitivity to potential contaminant sources since it is an unconfined aquifer. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

Three types of source water protection management regions for Roosville Border Station public water system were mapped as part of this assessment. They are the Control Zone, Inventory Region, and the Recharge Region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- The Control Zone is delineated as a 100-foot radius around the well and all sources of potential contaminants should be excluded in this region. The goal of management in the Control Zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. No significant potential contaminant sources were identified within the Control Zone.
- Since the source water is in an unconfined aquifer, the Inventory Region for the well consists of a one-mile radius circle around the wellhead. The Inventory Region should be managed to prevent contaminants from reaching the well. Significant potential contaminant sources that were identified within the Inventory Region include: a large capacity septic system, US Highway 93, and underground storage tanks.
- The goal of management in the Recharge Region is to maintain and improve water quality over long periods of time or increased usage. Because a large portion of the Recharge Region is located in Canada and maps are unavailable, a full evaluation of potential contaminate sources was not completed.

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried contaminant sources at concentrations that would pose concern. 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 public water supply well intakes. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource. Roosville Border Station public water supply well has a very high susceptibility to the large capacity septic system associated with Roosville Border Station. It also has a moderate susceptibility to US Highway 93 and the underground storage tanks in the Inventory Region.

The costs associated with contaminated drinking water are high. Developing an approach to protect that drinking water resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and other issues as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Inventory Region). We have identified several potential sources of contamination within the areas of interest. In addition, we provide you with recommendations (i.e., Best Management Practices) regarding the proper use and practices associated with some common potential contamination sources. We believe public awareness and active involvement by the PWS staff are powerful tools for protecting your drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality. Refer to the figures within the document to better understand the spatial relationship of the area. The susceptibility of the PWS to the significant potential contaminant sources is discussed in Table 9.

TABLE OF CONTENTS

INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was completed by Andrea Mazur, an intern with the Montana Department of Environmental Quality, Source Water Protection Program and was reviewed by Eric Sivers,a hydrogeologist with DEQ. Roosville Border Station Public Water System (PWS) # MT0001143 is located at 8395 US Highway 93 North at the Montana/Canada border. Contacts for the PWS are provided in Table 1 below.

Table 1. Roosville Border Station PWS Contacts

Name and Title	Telephone	Address
Mike Rutter Administrative Contact	406-889-2865	8395 US Highway 93 North Eureka, MT 59917
Shawna Horvath Financial Contact	406-441-1260	901 Front Street Suite 2300 Helena, MT 59626
Mike Rudder Operator		GSA/PBS P. O. Box 8389 Missoula, MT 59807

This report is intended to meet the technical requirements for the completion of the source water delineation and assessment report (SWDAR) for Roosville Border Station PWS as required by the Montana Source Water Protection Program (SWPP) and the federal Safe Drinking Water Act (SDWA). The Montana Source Water Protection Program (SWPP) is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana SWPP is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for Roosville Border Station PWS. Much of the content for this SWDAR has been borrowed from reports written for other Lincoln County PWSs.

Delineation is a process whereby areas that contribute water to aquifers or surface water used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation a of source water protection plan, the mechanism Roosville Border Station PWS can use to protect its drinking water source. Although voluntary, source water protection planning is the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to facilitate Roosville Border Station PWS and the community to be involved in source water protection planning activities that meet their specific needs.

CHAPTER 1
BACKGROUND

The Community

Roosville Border Station PWS supplies water to the Roosville Border Station located on US Highway 93 at the Montana/Canada border just north of Eureka. Eureka is located in the Tobacco River Valley, south of the Tobacco Plains area in the northeastern part of Lincoln County. The area is relatively isolated due to the mountains in the area, and is predominantly undeveloped at this time. Eureka is the largest town in the area and is located approximately 8 miles south of the Canadian Border. Eureka is the largest community with commercial services in the predominantly rural area, and provides services to international transportation through the Roseville Port of Entry on US Highway 93 north of town. The population of Eureka is approximately 1,092, as estimated in 1998. The economy of the area includes agriculture, the timber industry, tourism, and a Burlington Northern – Santa Fe Railroad facility. Rexford is located west of Eureka at the confluence of the Tobacco River into Lake Koocanusa.

DEQ records state that the PWS serves an average daily population of 26 employees year round, 100 people in the summer, and 25 people in the winter through three service connections. The available evidence suggests that sewage from the service area is disposed to a large capacity septic system.

Geographic Setting

The Tobacco River Watershed study area is present in a northwest to southeast trending regional valley system, referred to as the Rocky Mountain Trench (Figure 2). The valley system is a long linear feature that continues for over 1,000 miles northwest of Montana into the Yukon Territory of Canada. In northern Montana, the trench is bounded to the east by the Whitefish Mountains. The western border comprises the Salish Mountains south of the Kootenai River, and the Purcell Mountains north of the Kootenai River. The Kootenai River flows southward from Canada along the western part of the valley, and flows westward out of the trench near Rexford. The Kootenai River valley in this area holds Lake Koocanusa, which fills the valley from near Libby northward into Canada. The area is located within the upper reaches of the Kootenai River watershed (USGS Hydrologic Unit Code 17010101), located within the Westslope, or Columbia River Watershed Management Region for Montana.

The Tobacco Plains valley is a broad plain that fills the Rocky Mountain Trench north of Eureka. The principal stream across the northern part of the plain is Phillips Creek, which originates in Canada. Phillips Creek discharges into Sophie Lake, and the area represents a small, closed drainage basin. The topography of the Tobacco Plains records the history of glaciers that covered the area. The flat topography is interrupted by occasional drumlin hills and kettle lakes 20 to 100 feet deep. The mountains in the area are predominantly covered with evergreen forest, while the lower elevations are primarily open grassland.

Climate

The climate is typical of northwestern Montana. Precipitation averages 14.7 inches a year as measured at the weather station at the Eureka Ranger Station. The mountains and higher elevation areas obtain more precipitation, which is not reflected in this weather data. The wettest months are May and June averaging 1.81 and 2.15 inches monthly, respectively. The driest months are February and March, with both averaging 0.8 inches per month. The temperature ranges from an average high of 84.5 °F in July (minimum July average of 49.4 °F) to an average of 29.6 °F in January (minimum January average of 15.0 °F).

Figure 1. Regional Map

Figure 2. Roosville Border Station Inventory Region

Figure 3. Roosville Border Station PWS Geology Map

Description of the Source Water

Roosville Border Station PWS obtains water from one well (Well #2) and has a second well (Well #1) that is no longer connected to the PWS system. The location of the well is shown in Figure 2. This location is approximated based on a map provided in the most recent sanitary survey (2004), but is adequate for the purposes of this SWDAR. The well is completed in an unconfined aquifer.

Recharge to aquifers from precipitation and infiltration from streams is greatest from April to July because of stream runoff from accumulated winter snow in the surrounding mountains is augmented by an average of 3.76 inches of rain in May and June. Groundwater moves slowly through the aquifers and eventually either reaches streams to become base flow or is discharged by wells and springs or by evapotranspiration. Groundwater flow direction in this area is generally to the south.

The Public Water Supply

Roosville Border Station water system supplies water to 26 employees year round, 100 people in the summer, and 25 people in the winter through three service connections. There is one well and a pressure control system. The approximate location of Roosville Border Station PWS water supply well is shown on Figure 2. Well #1 (WL 002) was replaced by well #2 (WL003) in 2002. Well #1 has been disconnected from the PWS and Well #2 is the only well currently supplying water to this PWS. Well #2 (WL003) was completed in April of 2002. It has an 8-inch steel casing installed to 81 feet below ground surface (bgs). Static water level is listed as 55 feet bgs and the pumping water level was not listed. The well was grouted to 19 feet bgs with bentonite.

Table 2. PWS Facilities and Other Information

The Ranch HOAPWS (#MT0001143)

Contact Information		**Mike Rudder** **Administrative Contact,** **Financial Contact** **Roosville Border Station PWS** **8395 US Highway 93 North** **Eureka, MT 59917** **406-889-2865**	**Mike Rudder** **Operator** **GSA/PBS** **P. O. Box 8389** **Missoula, MT 59807**
PWS Class	Non-Transient, Non-Community PWS		
Well/Intake Source Code		WL003	
Well/Intake Name		Potable Water Well	
Status		Active	
Treatment System	None		
Pressure Control Assembly	PC 002 Pressure Control Assembly 2		
Distribution System	DS001 Distribution System Active		
Storage Tank	None		

Water Quality

Water quality data for Roosville Border Station PWS dating back five years was printed out from DEQ's PWS Database. This data indicates nitrate sample analyses produced nitrate concentrations between 0.29and 0.50 mg/L, which is well below the federal MCL of 10 mg/L. Total coliform results have been negative for the past five years. The operator for the PWS is required to monitor for several contaminants. Bacteriological samples should be completed on a quarterly basis; a nitrate sample should be done annually; monitoring of P2-5 inorganics is required once every three years, monitoring of SOCs, and VOCs, is required once every three years; and monitoring of lead, copper is required five times every three years.

CHAPTER 2
DELINEATION

General Discussion

The source water protection area, the land area that contributes water to Roosville Border Station PWS water supply, is identified in this chapter. Three management areas are identified within the source water protection area. These three regions are the Control Zone, Inventory Region, and Recharge Region. The Control Zone, also known as the exclusion zone, is an area of at least a 100-foot radius around the well. The Inventory Region represents the zone of contribution of the well, which approximates a three-year groundwater time-of-travel. This is sometimes approximated by a 1-mile radius. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping can often be used to calculate groundwater time-of-travel distance in sedimentary materials. In certain hydrogeologic settings where the aquifer behaves as if it were under confined conditions, the Inventory Region is restricted to the 1,000-foot radius circle around the wellhead. The Recharge Region represents the entire portion of the aquifer that contributes water to Roosville Border Station PWS water system. This is commonly, but not always, the watershed above a well.

Conceptual Model and Assumptions for the Aquifer

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. Groundwater occurs in the confined aquifer beneath the area. Low permeability glacial till impedes or limits direct surface infiltration of rain or snowmelt to the aquifer over much of the region except in areas where it is absent. Groundwater flow is generally to the south.

Hydrogeologic Conditions

After the glaciers retreated, the modern stream system of the Tobacco Plains developed. At places, the drainage system eroded into the glacial sediments, reworking some of the material into alluvium present within the modern riverbeds. The alluvium also contains material eroded from bedrock in the mountains adjacent to the area. Groundwater within the alluvium is generally in communication with surface water, with streams capable of both losing water to alluvium and gaining water from alluvium during different conditions. Groundwater within the glacial sediments is present in laterally discontinuous lenses of coarse-grained outwash and deltaic sediments which grade from coarse grained on the east side of the Tobacco Plains to fine grained near Lake Koocanusa.

Based on hydrogeologic conditions, **the Roosville Border Station PWS is classified as having a High Source Water Sensitivity**, according to the following table.

Table 3. Source Water Sensitivity

High Source Water Sensitivity
Surface water and GWUDISW
Unconsolidated Alluvium (unconfined)
Fluvial-Glacial Gravel
Terrace and Pediment Gravel
Shallow Fractured or Carbonate Bedrock
Moderate Source Water Sensitivity
Semi-consolidated Valley Fill sediments
Unconsolidated Alluvium (semi-confined)
Low Source Water Sensitivity
Consolidated Sandstone Bedrock
Deep Fractured or Carbonate Bedrock
Semi-consolidated Valley Fill Sediments (confined)

Well Information

The location of the Roosville Border Station PWS well is shown on Figure 2.

Table 4. Source Well Information For Roosville Border Station PWS

Information	Well # 1 (abandoned)	Well # 2
PWS Source Code	WL002	WL003
MBMG # (GWIC)	Unknown	Unknown
Water Right #	Unknown	Unknown
Date Well was Completed	04-01-1933	04-17-2002
Total Depth (feet bgs)	164	82
Casing Diameter (inches)	6	8
Casing Depth (feet bgs)	Unknown	81
Grout Depth (feet bgs)	Unknown	19, bentonite
Static Water Level (feet bgs)	Unknown	55
Pumping Water Level (feet bgs)	Unknown	Unknown
Yield \ Test Pumping Rate (gpm)	Unknown	40

Methods and Criteria

Source water protection areas are divided into zones or regions according to the amount of time water takes to reach the water supply intake or the hydrogeologic sensitivity of the source water. The intake for Roosville Border Station PWS water supply is the open-hole interval of the water supply well. Source water protection areas for groundwater-based systems, in order of increasing size, are: the Control Zone, Inventory Region, and Recharge Region. The methods and criteria used to delineate the source water protection zones for Roosville Border Station PWS are specified in the DEQ's SWPP (DEQ, 1999).

Table 5. Criteria for delineating source water protection regions.

If Your Source of Water Is:	Delineate These Water Protection Regions	Method For Each Region:	Minimum Distance Values
Unconfined / Semi-confined/Leaky-confined	- Control - Inventory - Recharge	-Fixed radius -Time-Of-Travel Calculation -Hydrogeologic Mapping	-Distance - 100 feet - Distance - Larger of 1,000 feet up-gradient or 3-year TOT or 1-mile radius (plus half-mile buffer around hydraulically connected surface water for 10 miles upstream*) -Physical and Hydrologic flow boundaries
*Ground Water that is hydraulically connected to Surface Water	-Surface Water Buffer Zone	- Fixed radius	-One-half mile buffer extending upstream a distance corresponding to a 4-hour TOT but not to exceed ten miles or the nearest intake. Buffer will not exceed the extent of the watershed.
Confined	- Control - Inventory - Recharge	-Fixed Distance - Fixed radius -Hydrogeologic Mapping	-Distance - 100 feet -Distance - Minimum of 1,000 feet - Physical and Hydrologic flow boundaries
Surface water	-Spill Response	-Fixed Distance	One-half mile buffer extending upstream a distance corresponding to a 4-hour TOT but not to exceed ten miles or the nearest intake. Buffer will not exceed the extent of the watershed.

For a confined aquifer, the Control Zone is based on a fixed distance of a 100 foot radius around each well; the Inventory Region is based on a 1,000-foot fixed radius circle around the wellheads, and the Recharge Region is based on geologic mapping and locations of hydrologic boundaries. If the aquifer is semi-confined or unconfined, the control and Recharge Regions are the same as for a confined aquifer, but the Inventory Region can be determined using a calculation of groundwater velocity and an estimated three-year groundwater time-of-travel (TOT) distance. When information is lacking, a fixed 1-mile radius circle around the wellheads can be used as a conservative and protective Inventory Region. This is most appropriate in areas of currently small inventories of potential contaminant sources or where future development may have progressively greater impacts on water quality.

Based on the available information, the aquifer supplying the Roosville Border Station PWS is an unconfined aquifer.

Delineation Results

The Control Zone is based on a fixed 100-foot radius around the well; the Inventory Region is based on a one-mile radius circle around the wellhead, as depicted on Figure 2. Because the well draws from an unconfined aquifer, the one-mile fixed radius circle Inventory Region is believed to be an appropriate estimate of the area that could contribute water to the aquifer beneath Roosville Border Station and should be protective of public health.

Limiting Factors

The available geologic evidence and regional geologic studies suggests that the aquifer beneath Roosville Border Station should be treated as an unconfined aquifer. The assumed groundwater flow direction and gradients in the area are based on regional data, but actual local gradients and flow directions may vary considerably. If more current data or information becomes available that is more specific to the immediate vicinity of the Roosville Border Station, the assumptions of this author about the aquifer characteristics and behavior of groundwater in the area may be revised.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for Roosville Border Station PWS within the Control Zone, Inventory Region, and Recharge Region. Potential sources of all primary drinking water contaminants were identified, however, the only significant potential contaminant sources were selected for detailed inventory. The most significant potential contaminants in the Roosville Border Station PWS Inventory Region include: a large capacity septic system, Highway 93, underground fuel storage tanks, and an abandoned mine.

The inventory for Roosville Border Station PWS focuses on all activities in the Control Zone, certain sites or land use activities in the Inventory Region, and major land uses and large facilities in the Recharge Region.

Inventory Method

The initial inventory of the three zones included a search of available databases to identify potential sources of impacts. 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: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html). Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from Flathead County.

Step 2: EPA's Envirofacts System (http://www.epa.gov/enviro/) was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), 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 should be classified as a significant potential contaminant source.

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts (http://www.epa.gov/enviro/) to identify Concentrated Animal Feeding Operations with MPDES permits. The water system operator or other local official familiar with the area included in the Inventory Region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the Inventory Region: Underground Storage Tanks (UST) (http://webdev.deq.state.mt.us/UST/), hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau), landfills, abandoned mines and active mines including gravel pits (http://nris.state.mt.us/gis/datalist.html). Any information on past releases and present compliance status was noted.

Step 5: Major road and rail transportation routes were identified throughout the Inventory Region (http://nris.state.mt.us/gis/datalist.html).

Step 6. All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the Recharge Region and identified on the base map.

Step 7: All wells located within the Inventory Region were identified and well logs were obtained when available.

Potential contaminant sources are designated as significant (DEQ, 2000) if they fall into one of the following categories:

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

Inventory Results/Control Zone

The Control Zone is the area immediately surrounding the well. The well is located approximately as shown on Figure 2. No potential contaminant sources were found in the Control Zone. However, the wells are located in close proximity to the vehicle check bays.

Inventory Results/Inventory Region

- The Inventory Region contains a few significant potential contaminant sources. These are: a large capacity septic system, Highway 93, underground fuel storage tanks, and an abandoned mine. Potential contaminant sources for the Inventory Region and Recharge Region are summarized in Table 6.

Table 6. Significant Potential Contaminant Sources for Roosville Border Station PWS

	Potential Contaminant Source	Contaminants
Control Zone	None identified	
Inventory Region	Large Capacity Septic System	Pathogens and Nitrate
	Abandoned Mine	
	Vehicular accidents with large volume spills, along Highway 93	VOCs, SOCs, Metals, other
	UST and LUST sites = underground fuel storage tanks and leaking underground fuel storage tank sites, these contain and may allow (or have allowed) the release of fuel to the ground surface or subsurface and may impact groundwater, located along the highways	VOCs (petroleum hydrocarbons)
Recharge Region	Potential contaminants are not inventoried.	

Inventory Results/Recharge Region

Contaminant sources are not identified for the inventory region; instead, land uses are evaluated. No data was available for the area in Canada, which represented a significant portion of the recharge area.

Inventory Update

Roosville Border Station PWS should update the inventory for their records every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory should be submitted to DEQ every five years to ensure that this source water delineation and assessment report remains 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 that is readily available through state documents, published maps and reports, GIS data, and discussions with people that are familiar with the area. Also, documentation may not be readily available on some potential sources. An example of this is the large capacity septic systems that are present in or around the Inventory Region. So every potential contaminant source may not have been identified or recognized as being a significant potential contaminant source. The author of this SWDAR is depending on local knowledge of the PWS owners and/or operator for site-specific knowledge.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

General Discussion

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Roosville Border Station PWS staff and the operator. 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 major land use activities or other significant activities in the Recharge Region pose minimal threat 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 PWS owners and the operator to reduce susceptibility are recommended in this chapter.

Hazard Determination

The susceptibility of the Roosville Border Station PWS production well to various types of contamination is assessed in the following paragraphs. The proximity of a potential contaminant sources to a well intake, potential contaminant migration pathways, or the density of potential non-point contaminant sources determines the threat of contamination, referred to here as hazard (Table 7). Hazard and the existence of barriers to contamination determine susceptibility, which is described in Table 8. Table 7 below describes the criteria to determine hazard within the Inventory Region as it was delineated in this SWDAR. Note that this table is specific to PWSs that draw their water from unconfined aquifers. The determination of hazard is somewhat different for other types of water sources. Records indicate that the casing was grouted to 19 feet with cement.

Table 7. Hazard of Potential Contaminant Sources

Unconfined Aquifers

Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Point Sources	Within 1 year TOT	Between 1 to 3 years TOT	Over 3 years TOT
Septic Systems	More than 300 per sq. mile	50-300 per sq. mile	Less than 50 per sq. mile
Sanitary Sewer (% land use)	More than 50% of region	20%-50% of region	Less than 20% of region
Cropped Agricultural Land (% land use)	More than 50% of region	20%-50% of region	Less than 20% of region

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 intake. First, hazard is rated by the proximity of a potential contaminant source to the PWS well or by a percentage of the area it occupies. Susceptibility ratings are then determined individually for each significant potential contaminant source and/or contaminant based on Table 8. These

susceptibility ratings are the evaluation of the vulnerability of well to the potential contaminant sources and are presented on Table 9.

Table 8. Susceptibility, based on Hazard and Barriers.

Presence Of Barriers	Hazard		
	High	**Moderate**	**Low**
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

Discussion of Susceptibility

A summary of the susceptibility assessment for Roosville Border Station PWS well is located in Table 9. Below is a brief discussion of the susceptibility assessment.

Large Capacity Septic Systems

Suggested management tools that can be used to reduce the impacts from septic waste on the deep aquifer within the Inventory Region include:

- Local promotion of advanced septic treatment systems. This is applicable to Roosville Border Station and surrounding areas.
- Public education concerning the proper handling and disposal of household chemicals. This is applicable to Roosville Border Station and surrounding areas.
- Aggressive maintenance and repair of the development's septic systems (including plumbing, tanks, and drainfields).
- Promotion of upgrading and maintenance of antiquated private septic systems.
- The potential development of local community sewer and wastewater treatment system (if feasible).

Highway 93

Accidents can and do happen along all roadways. Occasionally there are releases of large quantities of hazardous materials. These releases are rare events, but if they occur, they can be catastrophic for local groundwater quality. There appear to be multiple barriers in place and the Roosville Border Station well is only moderately susceptible to contamination from releases along the highway.

Underground Storage Tanks and Leaking Underground Storage Tanks

It is important to understand that leaking fuel storage tanks can seriously impact source water. There are several underground storage tanks and leaking underground storage tanks in the inventory region. Most facilities have some sort of management plans in place, do inventory monitoring, are overseen by DEQ, and may have emergency response and cleanup plans in place in case of future leaks.

Table 9. Susceptibility Assessment

Roosville Border Station – Inventory Region (only)

Source	Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Large Capacity Septic System	Nitrate, pathogens	Chronic leakage of effluent from poorly installed or maintained systems	**High Hazard**	None identified	**Very High Susceptibility**	Local promotion of advanced septic treatment systems, public education on proper waste disposal, possible development of community septic effluent collection and wastewater treatment system; restrict development of homes or industry on the area of thin or absent glacial till (where bedrock is exposed at the surface)
Underground Storage Tanks	VOCs	Ongoing or catastrophic leakage into groundwater	**Moderate Hazard**	- Local emergency response capability and planning	**Moderate Susceptibility**	Support maintenance, rehabilitation, or replacement of existing tanks, and rapid response planning for leaks or ruptures.
US Highway 93	Pesticides, fertilizers, VOCs, SOCs, other	Contaminants leaching into groundwater	**Moderate Hazard**	- Emergency response planning	**Moderate Susceptibility**	Encourage and support emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry and spills away and prevent infiltration into ground, cooperation with railroad managers or MDOT to reduce herbicide use.

Summary of Susceptibility

The Roosville Border Station public water supply uses one production well. The aquifer beneath Roosville Border Station is considered an unconfined aquifer. The groundwater beneath the area of the wells is believed to flow to the south. For the purposes of this delineation and assessment, the Inventory Region is a one-mile radius circle around the wellhead. The few significant potential contaminant sources that were identified in the Inventory Region can affect water quality at the PWS. The potential contaminant sources found within the Inventory Region of greatest significance are:

- The large capacity septic system. This is assigned a high hazard.
- The underground fuel storage tanks are assigned a moderate hazard.
- US Highway 93 is assigned a moderate hazard.

Natural or engineered barriers are identified that reduce the well's susceptibility to these potential contaminant sources. The Inventory Region is depicted on Figure 2, and the susceptibility of the PWS is discussed on Table 9.

It should be noted that several assumptions were made to develop this delineation and assessment. The aquifer that provides water to the PWS well appears to behave under unconfined conditions. It is possible that further study may prove otherwise. Because a contaminant source has not been identified in the inventory or susceptibility assessment of this report, it doesn't mean that the potential source is not there or that the potential for contamination does not exist (it is not a threat). So, if potential contaminant sources were present near or upgradient of any PWS, it would be prudent to understand the threat from these sources.

Monitoring Waivers

Introduction and Waiver Requirements

This section addresses the Roosville Border Station PWS that DEQ has classified as a Non-Transient, Non-Community System. The authors' recommendation is based upon the determination of susceptibility as described above. The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for the organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls are excluded from monitoring requirements by statewide waivers.

Types of Waivers

Use Waivers

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

Susceptibility Waivers

If a Use Waiver is not granted, a system may still be eligible for a Susceptibility Waiver, if through a vulnerability assessment it is demonstrated that the water source would not be susceptible to contamination. Susceptibility is based on prior analytical or vulnerability assessment results,

environmental persistence, and transport of the contaminants, natural protection of the source, wellhead protection program efforts, and the level of susceptibility indicators (such as nitrate and coliform bacteria). The vulnerability assessment of a surface water source must consider the watershed area above the source, or a minimum fixed radius upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of 1.0 miles as an area of investigation for the use of organic chemicals (or 1,000-foot radius circles around the well in the case of confined aquifers). 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.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include well logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; Time-of-Travel or attenuation studies; vulnerability mapping; and the use of computerized groundwater flow and transport models. Review of an organic chemical monitoring waiver application will be conducted by DEQ's PWS Section and DEQ's Source Water Protection Program. 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 differ from confined aquifers in that the groundwater is not regionally overlain by relatively impervious geologic strata. As a result, the upper groundwater surface or water table in an unconfined aquifer is not under pressure that produces hydrostatic head common to confined aquifers.

Unconfined aquifers are often locally recharged from surface water or precipitation. In general, groundwater flow gradients in unconfined aquifers may reflect surface topography, and the residence time of water in the aquifer is typically comparatively shorter than for water in confined aquifers. Consequently, unconfined aquifers can be susceptible to contamination by organic chemicals migrating from the ground surface or surface water to groundwater.

<u>Susceptibility Waiver Application Objective</u>

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration of contaminants into water that is used as a source. The general procedures make use of a combination of site-specific information pertaining to the location and construction of the water source development, monitoring history of the source, geologic/hydrologic characteristics of the source water, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The area of contribution to the aquifer into which the PWS intake is installed must be defined and plotted. This should describe the subsurface stratigraphy, groundwater and aquifer characteristics, well construction, groundwater flow direction(s), and a listing (and a map) of other wells in the area that draw from the same formations. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well(s) should also be provided as part of the susceptibility waiver application.

<u>Waiver Recommendation of this SWDAR</u>

Based on past monitoring results and the susceptibility assessment of the Roosville Border Station PWS, the PWS appears to be eligible for several monitoring waivers. DEQ records suggest that the PWS currently has no monitoring waivers in-place. Based on the monitoring history for the wells, the results

of the inventory, the susceptibility assessment of this SWDAR, the geology of the area, the nature of the aquifer from which the wells draw water, the PWS production well is probably not a good candidate for volatile organics (VOCs) waivers or synthetic organics (SOCs) waivers. Once the source has the required monitoring history, the PWS is probably eligible for inorganic chemical (IOC) waivers. For monitoring waiver consideration, the PWS should submit a letter to DEQ requesting the specific monitoring waivers.

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GLOSSARY*

Acute Health Effect. A negative health effect in which symptoms develop rapidly.
Alkalinity. The capacity of water to neutralize acids.
Aquifer. A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.
Barrier. A physical feature or management plan that reduces the likelihood of contamination of a water source from a potential contaminant source
Best Management Practices (BMPs). Methods for various activities that have been determined to be the most effective, practical means of preventing or reducing pollution.
Biennial Reporting System (BRS). An EPA database that contains information on hazardous waste sites. The data can be accessed through the EPA Envirofacts website.
Chronic Health Effect. A negative health effect in which symptoms develop over an extended period of time.
Class V Injection Well. Any pit or conduit into the subsurface for disposal of waste waters. The receiving unit for an injection well typically represents the aquifer, or water-bearing interval.
Coliform Bacteria. A general type of bacteria found in the intestinal tracts of animals and humans, and also in soils, vegetation and water. Their presence in water is used as an indicator of pollution and possible contamination by pathogens.
Community. A town, neighborhood or area where people live and prosper.
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 does not allow the flow of water, maintaining the pressure of the ground water in the aquifer. The physical properties of a confining unit may range from a five-feet thick clay layer to a shale that is hundreds of feet thick.
Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Passed in 1989 by the Montana State Legislature, CECRA provides the mechanism and responsibility to clean up hazardous waste sites in Montana.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup. The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) provides information about specific sites through the EPA Envirofacts website.
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.
Hydrology. The study of water and how it flows in the ground and on the surface.
Hydrogeology. The study of geologic formations and how they affect ground water flow systems.
Inventory Region. A source water management area for ground water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three-year ground water travel time.
Leaking Underground Storage Tank (LUST). A release from a UST and/or associated piping into the subsurface.
Maximum Contaminant Level (MCL). Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act to establish concentrations of contaminants in drinking water that are protective of human health.
Montana Bureau of Mines and Geology – Ground Water Information Center (MBMG/GWIC). The database of information on all wells drilled in Montana, including stratigraphic data and well construction data, when available.
Montana Pollutant Discharge Elimination System (MPDES). Database system to track entities that discharge wastewater of any type into waters of the State of Montana.
National Pollutant Discharge Elimination System (NPDES). A national database system to track entities that discharge wastewater.
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. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of chemicals into surface and/or ground waters 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 fixed facility from which pollutants are discharged.
Permit Compliance System (PCS). An EPA database that provides information on the status of required permits for specific activities for specific facilities. The data can be accessed through the EPA Envirofacts website.
Public Water System. A system that provides water for human consumption through at least 15 service connections or regularly serves 25 individuals.
Pumping Water Level. Water level elevation in a well when the pump is operating.
Recharge Region. A source water management region that is generally the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.
Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. The Resource Conservation and Recovery Information System (RCRIS) provides information about specific sites through the EPA Envirofacts website.
Secondary Maximum Contaminant Levels (SMCL). The maximum concentration of a substance in water that is recommended to be delivered to users of a public water supply, based on aesthetic qualities. SMCLs are non-enforceable guidelines for public water supplies, set by EPA under authority of the Safe Drinking Water Act. Compounds with SMCLs may occur naturally in certain areas, limiting the ability of the public water supply to treat for them.
Section Seven Tracking System (SSTS). SSTS is an automated system EPA uses to track pesticide producing establishments and the amount of pesticides they produce.
Source Water. Any surface water, spring, or ground water source that provides water to a public water supply.
Source Water Assessment Report. A report for a public water supply that delineates source water protection areas, performs 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 ground water sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.
Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.
Static Water Level (SWL). Water level elevation in a well when the pump is not operating.
Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.
Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. herbicides and pesticides).
Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.
Toxic Release Inventory (TRI). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.
Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.
Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.
Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.
Volatile Organic Compounds (VOC). Chemicals such as petroleum hydrocarbons and solvents or other organic chemicals, which evaporates readily to the atmosphere.

*** Definitions adapted from EPA's Glossary of Selected Terms and Abbreviations (http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html) and other sources.**

APPENDICES

Appendix A
Well Log

Appendix B
Sanitary Survey

Appendix C
DEQ PWS Database Water Quality Data