Pretty Eagle School

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

11/99

Pretty Eagle School
Public Water System
Big Horn County

PWSID #
MT0003943

Date of Report: 10/10/02

Ken Hanic**,**
Certified Operator

PO Box 257
St. Xavier, MT 59075

Phone: (406) 666-2215

Prepared By
Karen LaClair, Chad Walby and Steve Custer
Montana State University
Bozeman, MT
59717-3480
PH: 406 994 6906

Table of Contents

INTRODUCTION

This report is intended to meet the technical requirements for the completion of the Source Water Delineation and Assessment for the Pretty Eagle School Public Water Supply System (PWSID# 03481) as required by the Montana Source Water Protection Program and the federal Safe Drinking Water Act (SDWA). The Source Water Delineation and Assessment Report (SWDAR) for the Pretty Eagle School was completed by MSU students Chad Walby and Karen LaClair under the supervision of Dr. Steve Custer, at Montana State University.

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program 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 Pretty Eagle School.

Delineation is a process whereby areas that contribute water to aquifers or surface waters 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 identification of locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determination of the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of source water protection plans, the mechanism Pretty Eagle School can use to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Pretty Eagle School water operator and the community to complete a source water protection plan that meets their specific needs.

CHAPTER 1
BACKGROUND

THE COMMUNITY

Pretty Eagle school is considered a non-transient non-community public water supply system because it regularly serves at least 25 of the same persons over six months, but less than 12 months per year (Appendix D, Cadmus Group Inc., 2000). The school is located to the East of St. Xavier in Big Horn County, 33 miles south of Interstate 90 at Hardin; on Highway 313 (Appendix A, Fig. 1 and 2).

The population of Big Horn County according to Census 2000, was 12,671. Approximately 67 residents live in St. Xavier (Census Bureau). Retail Trade, Accommodation and Food Services, and Health Care and Social Assistance make up the economic base of Big Horn County (Census Bureau).

St Xavier is not served by a sanitary sewer system. Each residence is served by an on-site septic system and drainage field.

GEOGRAPHIC SETTING

Pretty Eagle school is in the Unglaciated, Northern Great Plains physiographic province of North America (Howard and Williams, 1972) and the nonglaciated central ground-water region of the United States (Heath, 1984). Pretty Eagle school is located about ½ mile west of St. Xavier, on Rotten Grass Creek, approximately 1.5 miles downstream from the location of Pretty Eagle School, Rotten Grass Creek flows into the Bighorn River (Figure 1). The elevation of Pretty Eagle is 3065 feet. Pretty Eagle is in the Lower Bighorn watershed, hydrologic unit code 10080015 (EPA).

Climate data for the Pretty Eagle area is collected from the NRCS National Water and Climate Center online database, from the nearest weather stations, at the Crow Agency to the Northeast and Yellowtail dam, to the Southwest. The average low and high temperatures for the Crow Agency area are 5.9 and 33.4 degrees Fahrenheit in January, and 53.5 and 90.1 degrees Fahrenheit in July. The average low and high temperatures for the Yellowtail Dam area are 15.7 and 37.7 degrees Fahrenheit in January and 57.5 and 89.4 degrees Fahrenheit in July. The Crow Agency receives 15.4 inches of precipitation and 41.2 inches of snowfall annually. The Yellowtail Dam receives 18.45 inches of precipitation and 33.9 inches of snowfall annually.

Soil at Pretty Eagle is classified as Lohmiller silty clay loam (Lo) and channeled Haverson and Lohmiller (Hgb) soils. Lohmiller silty clay loam is nearly level on low terraces and flood plains (0-2 percent slopes). Runoff is usually slow with only slight erosional hazard. The soil is suitable for irrigated and dry farmed crops, hay, wildlife, recreation, and range. The Haverson-Lohmiller channeled soils consist of Haverson loam, Haverson silty clay loam, and Lohmiller silty clay. The two Haverson soil types have slopes from 0 to 2 percent with slow runoff and slight hazard of runoff. The soil profile for both Haverson soils is as follows: grayish-brown loam; light yellowish-brown loam; light brownish-gray stratified silt loam and sandy loam; light yellowish-brown light sandy loam. Slopes for the Haverson-Lohmiller channeled deposits are 15-35 percent on the sides of stream channels, as for the study area. Runoff is slow and the erosional hazard is severe. The Haverson-Lohmiller channeled soils are suitable for range, wildlife, and recreation (Natural Resources & Conservation, 1977).

GENERAL SOURCE WATER DESCRIPTION

Groundwater is the source of drinking water for the Pretty Eagle School. There are three wells on the Pretty Eagle school grounds. The well from which the school receives water was drilled on April 14, 1998. The well is drilled to a depth of 47 feet and grouted to 22 feet (GWIC, see well log in Appendix C). The well was likely completed in Quaternary terrace deposits (Paleocene, 0.02-1.4 Ma). Terrace deposits are gravel, sand, silt, and clay, and are adjacent to and above modern streams. Gravel in the terrace deposits consists of rounded to subrounded clasts of limestone and dolomite, andesite, and other mafic volcanic rocks, quartzite, granitic rocks, sandstone, and chert, in order of abundance (Vuke, et. al., 2000, see Figure 6d, Appendix A).

The sanitary survey, conducted December 11, 2000 states that there is a second well on the grounds that was artesian and abandoned (Cadmus Group Inc., 2000). A previous sanitary survey, submitted by McNenny Environmental Engineering and Consulting (surveyor, Darrell McNenny) on May 22, 1997, suggests that the well was drilled at some time around 1969, with an artesian pressure of 30 pounds per square inch (psi) (McNenny, Appendix D). All information, according to the sanitary survey, is unknown, except that the casing size was 6 inches. The sanitary survey states that the well was being used for the bathroom stools and hand basins, and in the kitchen for all dishwashing. Water for drinking and cooking purposes was being hauled in due to high fluorides from the well (15 mg/l) (McNenny, 1997, Appendix D, Sanitary Surveys).

The sanitary survey submitted in 1997 suggests (on page 6) that there is a third well on the school property that had not been properly abandoned, and needed to be so. The sanitary survey conducted in 2000 states that the third well on site had been abandoned and plugged with 8 feet of bentonite, and then capped (Appendix D, Sanitary Surveys).

PUBLIC WATER SUPPLY

There is one well currently supplying groundwater to the Pretty Eagle School. The well (PWS ID 03943, source 003) serves approximately 22 people in the summer and 167 people the rest of the year on four active service connections (Cadmus Group, Inc., 2000). The approximate volume of water used during the year is 4175 gallons per day during the year, and 550 gallons per day during the summer (EPA, 1991). Water from the well is pumped to a 40,000 gallon concrete storage tank. The water is chlorinated prior to storage in the storage tank. The structure of the water system prior to emplacement into the storage tank is unclear. The water is then pumped from the storage tank to the system via a three horsepower pump, and/or a five horsepower pump. The water is softened prior to being distributed to the complex. A 10 horsepower emergency/fire pump is available but the flow bypasses the water softener. The water for the drinking fountains and the kitchen is additionally treated by a reverse osmosis system located in the laundry room of the main school building (Cadmus Group Inc., 2000, Appendix D, Sanitary Surveys). The school is served by a large capacity septic system located somewhere on school property.

WATER QUALITY

Available regional background water quality for Pretty Eagle School is presented in Table 1. Data were acquired from the GWIC database for the terrace deposits surrounding Pretty Eagle School. A search was made along the length of Rotten Grass Creek on a section by section basis. Specific electrical conductivity at 25 °C had a mean value of 360 micromhos, with a low of 213 micromhos and a high of 667 micromhos. Data indicates that the water is sodium, calcium, bicarbonate groundwater.

The Pretty Eagle school PWS is routinely monitored for compliance with drinking water standards. Bacteriological monitoring occurs monthly. Compliance with other drinking water standards is based on additional sampling on a variety of schedules depending on system classification and population served. Nitrate can come from human or animal wastes and can also occur naturally. The highest nitrate level detected in the Pretty Eagle School well in the last five years is 0.28 mg/l. The U.S. Environmental Protection Agency (EPA) standard for maximum allowable nitrates is 10 mg/l, well above the highest reading taken at Pretty Eagle School. The Pretty Eagle school well has tested free of bacteria for the last 5 years.

Table 1a. Regional water quality for Quaternary Terrace deposits in the St. Xavier area.

GWIC Id	Aquifer	Latitude	Longitude	Town, Range, Section	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Cl (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	SO4 (mg/l)	NO3 (mg/l)	F (mg/l)	SiO2 (mg/l)
7552	Terrace	45.5183	-107.723	04S,32E,2AAA	524	249	1000	10	155	455	0	3930	1.99	0.5	27
7553	Terrace	45.463	-107.729	04S,32E,23DC	419	84	200	6.8	24	446	0	1360	0.14	0.6	22
7554	Terrace	45.4633	-107.729	04S,32E,23DCAD	286	114	275 K		22	425	0	1376	<.023		21
7555	Terrace	45.455	-107.732	04S,32E,26BDD	213	189	490	9.2	38	471	0	1930	2.1	0.7	26
7556	Terrace	45.4413	-107.713	04S,32E,36BD	259	82	168	5.9	16	457	0	938	0.75	0.5	20
7556	Terrace	45.4413	-107.713	04S,32E,36BD	377	121	197	6.8	19	516	0	1330	1.63	0.6	24
				MAX	524	249	1000	10	155	516	0	3930	2.1	0.7	27
				MIN	213	82	168	5.9	16	425	0	938	0.14	0.5	20
				MEAN	346.3	139.8	411	7.74	45.67	462	0	1811	1.322	0.58	23.3

Table 1b. Regional water quality for Quaternary Terrace (Qat) deposits in the St. Xavier area, continued.

GWIC ID	B (µg/l)	Fe (mg/l)	TDS	Cations	Anions	Lab pH	Lab SC (µmhos @ 25°C)
7552	810	0.09	6121.72	90.40281	93.863	7	667
7553	450	1.3	2337.54	36.76046	36.357	7	272
7554		1.6	2304.96	35.69846	36.251		
7555	1100	0.14	3130.16	47.73951	49.182	7.3	378
7556	530	0.34	1715.61	27.14988	27.561	7.1	213
7556	830	0.17	2331.39	37.51839	36.846	6.9	269
MAX	1100	1.6	6121.72	90.40281	93.863	7.3	667
MIN	450	0.09	1715.61	27.14988	27.561	6.9	213
MEAN	744	0.606667	2990.23	45.87825	46.67667	7.06	359.8

CHAPTER 2
DELINEATION

All source water protection areas for the Pretty Eagle School well were delineated as required for non-transient, non-community public water supplies under the Montana Source Water Protection Program (DEQ, 1999). A 100-ft radius control zone was delineated for the Pretty Eagle School. The control zone is the most critical area within which direct introduction of contaminants into the well or immediate area can occur. An inventory region using a 1 mile fixed radius was delineated for the Pretty Eagle school well, according to the criteria for a non-transient, non-community well. The Inventory Region represents an area from which water or contaminants can flow to the well over a period of months to years. The recharge region was delineated using hydrogeologic mapping and analysis. This region represents the entire area contributing recharge water to groundwater that may flow to a drinking water supply over long time periods or under a higher pumping rate.

HYDROGEOLOGIC CONDITIONS

Geologic maps available for the area are listed in Table 1. Groundwater flow direction in the region is not documented in any studies of the area. Land surface elevation in the area of Pretty Eagle School decreases going North toward the Yellowstone River.

Table 1. List of geologic maps available for Pretty Eagle school area.

Title or Description	Date	Area Covered	Reference
Geologic Map of the Lodge Grass 30’ x 60’ quadrangle, Montana	2000	Lat 45° to 45°,30’ Long 107° to 108°	MBMG, USGS, map series, no. 56 Vuke, Susan M., et. al.
Geologic Map of Montana	1955	State of Montana	Ross, Clyde P., Andrew, David A., Witkind, Irving, Montana Bureau of Mines and Geology
Geology of the Hardin Area, Bighorn and Yellowstone Counties, MT	1951	Hardin, MT, south to the MT/WY boundary	Oil and Gas Investigations, Map OM 111, Sheet 1, Richards, P.W., Rogers, C.P.
Geologic Map of Montana	1944	Eastern Montana	Oil and Gas Investigations, Preliminary Map 25, sheet 1, Andrews, D.A., Lambert, G.S., Stose, G.W.

There are two aquifers in the vicinity of Pretty Eagle School, Quaternary alluvium and Quaternary terrace deposits. Quaternary alluvium occurs up to 35 feet thick. Quaternary terrace deposits occur up to 49 feet thick (Vuke, et. al., 2000). Alluvial wells are typically less than 35 feet deep (GWIC). Wells finished in the alluvium are all very near to either the Big Horn River or Rotten Grass Creek. Wells finished in the quaternary terrace deposits extend 2 to 3 miles to either side (east or west) of the Big Horn River (GWIC).

CONCEPTUAL MODEL AND ASSUMPTIONS

There are two main aquifers in the Pretty Eagle school area, Quaternary Alluvium (Qal) and Quaternary Terrace (Qat) deposits. Wells drilled directly into Qat typically consist of 2 feet of soil, followed by 9 to 30 feet of clay, finishing in up to 30 feet of sand and gravel (GWIC). Quaternary Alluvium (Qal) in the area is restricted adjacent to Rotten Grass Creek and the Big Horn River, being as thick 35 feet (Vuke, et. al., 2000, see Figure 6b, Appendix A, for area geology, Figure 6c and Figure 6d for Key and Lithologic descriptions, respectively).

Quaternary terrace deposits overly the Belle Fourche Shale formation (Kbf), which outcrops to the East. The attitude of bedding in the area suggests that the strata underlying alluvial and terrace deposits at Pretty Eagle School is dipping slightly (2°- 3°) to the east (Vuke, et. al., 2000). Further evidence of the Eastward dip of strata underneath the Pretty Eagle area comes from structure-contours of the Mowry shale, which also suggest eastward dip (Richards, et. al., 1951). The Belle Fourche is up to 475 feet thick and is composed of a dark gray shale and sandy shale. The lower and upper parts contain 6 to 7 foot thick bentonite beds. The middle of the Belle Fourche contains the Soap Creek bentonite bed, which is 197 feet thick (Vuke, et. al., 2000). Underlying the Belle Fourche are the Thermopolis and Mowry shale formations. Such a thick succession of shales with bentonite assures that groundwater flow is shallow and that no flow from bedrock is contributing water to the Quaternary alluvial and terrace deposits which supply the Pretty Eagle School well.

Quaternary terrace deposits in the Big Horn Valley occur vertically above and adjacent to Quaternary alluvium. Though no hydrogeologic investigations exist for the area, spatial relationships suggest that Quaternary terrace deposits in the area of the Pretty Eagle well contains an areally consistent clay layer. Wells drilled below the clay layer in the Quaternary terrace deposits are confined from adjacent rivers by the clay layer (GWIC). Over a mile to the East, one well log was found that suggests the clay layer no longer exists (mnumber 101881, 4S, 33E, Section 19, GWIC). Consulting well logs in conjunction with topography and thickness of Quaternary deposits (Qal, Qat) to the East, suggests that water flows in Quaternary terrace deposits from East to West. The recharge area, then, extends to the Easternmost extent of the Quaternary deposits (Qat, Qal) (see Figure 5 and Figure 8, Appendix A). Groundwater flow direction is assumed to follow topography in the absence of a hydrogeologic study. The Northern extent of the recharge boundary is then delineated as the line along coincident topographic normal line/tangent to the inventory zone circle. The Southern extent of the recharge zone also follows a normal to the inventory region circle. Both the North and South borders are truncated to the East and South by the contact between Quaternary deposits and Belle Fourche shale (Kbf). The border of the recharge zone is then closed by following the boundary between the Quaternary terrace and Cretaceous Belle Fourche shale deposits to Rotten Grass Creek alluvium, then up the alluvium to a point 10 miles from the Pretty Eagle well. The aquifer is being treated as semi-confined because there is a convincing confining clay layer, though the extent of the clay layer is unknown. The aquifer is considered to be moderately sensitive to potential contaminant sources at the land surface in accordance with the Montana Source Water Protection Program Guidelines (DEQ, 1999).

WELL INFORMATION

The well from which Pretty Eagle School gets water (source 003) is west of the 40,000 gallon storage reservoir. This well was completed on April 14, 1998, according to the latest sanitary survey (Cadmus Group Inc., 2000, Appendix D, Sanitary Surveys). The well was drilled to a depth of 47 feet according to the well log (GWIC, see well log in Appendix C). The depth of drilling suggests that it is completed in quaternary terrace deposits. 8 5/8' casing was installed to a depth of 37 feet. The well was grouted to 22 feet of depth, and was screened from 37 to 47 feet.

The well from which the school previously drew water (002) is east of well 003. Information on the artesian well 002 is limited to approximate date of drilling (1969) and casing size (6 inches) (McNenny, 1997, Appendix D, Sanitary Surveys). See Table 2 for well information.

Table 2. Source well information for Pretty Eagle School

Information	Well #1	Well #2	Sources of Information
PWS Source Code	002	003	McNenny 1997 and Cadmus 2000, respectively
MBMG #	None	196431	GWIC
Water Right #	N/A	105046	GWIC
Legal Location	4S,32E, 23DCD	4S,32E, 23DCD	McNenny 1997 and Cadmus 2000, respectively
Latitude/Longitude	45.4614°/ 107.7292°	45.4614/ 107.7264	McNenny 1997 and Cadmus 2000, respectively
Date Completed	1969	1998	McNenny 1997 and Cadmus 2000, respectively
Well Depth	Unknown	47'	McNenny 1997 and Cadmus 2000, respectively
Perforated Interval	Unknown	37-47'	McNenny 1997 and Cadmus 2000, respectively
Static Water Level Depth	Artesian, 30 psi	19'	McNenny 1997 and Cadmus 2000, respectively
Pumping Water Level Depth	Unknown	Unknown	McNenny 1997 and Cadmus 2000, respectively
Drawdown	Unknown	22.5	McNenny 1997 and Cadmus 2000, respectively
Test Pumping Rate	Unknown	Unknown	McNenny 1997 and Cadmus 2000, respectively
Specific Capacity	Unknown	Unknown	McNenny 1997 and Cadmus 2000, respectively

Source Type	Terrace	Terrace	Vuke, et. al., 2000

LIMITING FACTORS

No hydrogeologic investigations have been done around the Pretty Eagle school area, so direct knowledge of hydrogeologic conditions does not exist. However, the spatial relationship between Qal and Qat suggests water flows toward the river, coincident with topography, from the Kbf/Qat boundary to Qal. The aquifer is being treated as semi-confined because there is a convincing confining clay layer, though the extent of the clay layer is unknown. Rotten Grass Creek alluvium is included upstream because it may be in connection with the aquifer.

CHAPTER 3
INVENTORY

Montana Source Water Protection Program (DEQ, 1999) requires that land uses and all potential contaminant sources be identified within the control zone and inventory region of non-transient non-community public water supplies. Inventory of potential sources of contamination was conducted for Pretty Eagle School within the control and inventory regions. The significant potential contaminants in the Pretty Eagle School inventory region are nitrate, pathogens, fuels, solvents, and agricultural chemicals.

The inventory for Pretty Eagle School focuses on all activities in the control zone, certain sites or land use activities in the inventory region, and general land uses and large facilities in the recharge region.

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: 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 use was identified from boundaries of sewer coverage obtained from municipal wastewater utilities.

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 (http://nris.state.mt.us/gis/datalist.html), abandoned mines (http://nris.state.mt.us/gis/datalist.html) and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: A business phone directory was queried 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 SIC code.

Step 6: Major road and rail transportation routes were identified throughout the inventory region (http://nris.state.mt.us/gis/datalist.html).

Step 7. 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 8: All wells located within the inventory region were identified and well logs were obtained when available.

Step 9: The 1929 Sanborn Insurance Co. fire maps were reviewed to identify historic sources of potential contaminants.

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) 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 % 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

Pretty Eagle School owns most of the land within the 100-foot control zone. This was determined by viewing the ortho photo of the vicinity (Appendix A, Figure 4). The southernmost strip of the control zone contains BIA road 91. This is the only land inside the control zone the school does not own. The only other possible route for contaminants inside the control zone is through the abandoned, capped artesian well, if it were to become contaminated. The school should consider limiting the washing of fertilizer, pesticide, and herbicide application equipment near the well and should consider restricting agricultural chemicals in this zone.

INVENTORY RESULTS/INVENTORY REGION

Land cover information for the Pretty Eagle School inventory region (Appendix A, Figure 7) was summarized from the National Landcover Dataset, Montana (USGS, 2000). In addition, a pie chart showing land use breakdown is included (Appendix A, Figure 9). Land cover within the 1-mile inventory zone of the Pretty Eagle school includes 51% small grains, 15% row crops, 14% pasture/hay, 6% grassland/herbaceous, 5% fallow, 5% shrubland, 4% woody wetlands and deciduous forest, and less than 1% open water and evergreen forest. Agricultural land is considered a significant potential contaminant source and at 85% is given a high hazard rating.

The school's large capacity septic system and drainfield are located within the inventory regions and are assigned a high hazard rating in accordance to the Montana Source Water Protection Program (DEQ, 1999).

Sanitary survey diagrams indicate some potential contaminant sources. An old abandoned well just to the North of the tanks may provide a pathway for contamination to the groundwater along the outside of the casing but the well has been sealed with 8 feet of bentonite: This seal is a barrier to contamination (Cadmus Group Inc., 2000).

A further threat to water quality is a leaking underground storage tank located off the Northwest corner of the school (Appendix A, Figure 4). The DEQ database lists this LUST (leaking underground storage tank) as active, and it is considered a high hazard. See Table 5 for available information about the LUST.

Table 3. Significant potential contaminant sources for the Pretty Eagle School.

Source	Contaminants	Description
LUST/UST	VOC's, SOC's, inorganics	Contaminants leaching to groundwater

Highways	All	Contaminants leaching to groundwater
Railways	All	Contaminants leaching to groundwater
Cultivated cropland	Pathogens, nitrates, agchemicals	Nitrates, pathogens, and agchemicals leaching to groundwater
Septic Systems	Pathogens and Nitrates	Nitrates and pathogens leaching to groundwater

Two main roads in the inventory region and BIA road 91 directly to the South of the school and Highway 313, which enters St. Xavier from the East and exits St. Xavier Southward. BIA road 91 is not a through road, is secondary and so has a low hazard. Highway 313 lies a third of a mile from the school, but crosses Rotten Grass Creek upstream from the school, so is still considered to be a moderate hazard.

INVENTORY RESULTS/RECHARGE REGION

Land cover within the Pretty Eagle School recharge region (Appendix A, Figure 7) includes 35% Small Grains, 22% Grassland/Herbaceous, 13% Shrubland, 10% Pasture/Hay, 7% Row Crops, 5% Fallow, 5% Deciduous Forest, and 1% Woody Wetlands and Open Water. A pie chart is included with the percentage breakdown for Landcover in the recharge region (Appendix A, Figure 10). Additional possible contaminant sources in the recharge region include 2 gravel pits located southeast of the inventory zone along Rotten Grass Creek where the creek enters the valley from uplands to the East (Appendix A, Figure 5).

Table 4. Underground Storage Tanks Listed with the Montana DEQ.

AltFacilityID	Facility Name	Street Address	City	County	ActiveTanks	NonactiveTanks
02-02408	Ft Custer Radio - AT&T	NW Of St Xavier	Saint Xavier	Big Horn	Not listed	1
02-09316	Kehler, Richard	General Delivery	Saint Xavier	Big Horn	Not listed	1
02-03655	Saint Xavier Mercantile	103 Fort Smith Ave	Saint Xavier	Big Horn	Not listed	2
02-05855	St Xavier Cafe	Hwy 313	Saint Xavier	Big Horn	Not listed	2

Table 5. Leaking Underground Storage Tanks listed with Montana Department of Environmental Quality.

City	SiteName	Location	AltEventID	Date	Confirmed Release Date	Project Officer	Active
Saint	St Xavier	1 Mile	0204504*3289	17-	17-Nov-97	Kirth A	Yes

Xavier	School	West		Nov-97		Erickson	

INVENTORY UPDATE

The certified operator will update the inventory for his or her records every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

INVENTORY LIMITATIONS

The potential sources of contamination for the Pretty Eagle School have been identified using readily available data and reports. Unregulated activities or unreported contaminant releases may have been missed. The use of multiple sources of data, however, should ensure that the major potential contaminant threats to the Pretty Eagle School are known.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

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 Pretty Eagle School.

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 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 Pretty Eagle School to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers (Table 6) that decrease the likelihood that contaminated water will flow to the Pretty Eagle School well. Hazard for confined aquifers is low if all wells in the inventory region are constructed to current state standards. Hazard is high if the PWS well is not sealed into the confining layer and moderate if only other wells are not properly constructed.

Table 6. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of 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

Susceptibility ratings are presented in Table 7 for each significant potential contaminant source and each associated contaminant. The well itself is located in alluvium adjacent to a stream and is in close proximity to significant possible contaminant sources. The well itself appears to be sealed through the confining clay layer. Well logs indicate that other wells in the area are not sealed through the confining clay layer. Insufficient information exists to determine whether the clay layer is continuous throughout the inventory region.

Thus, the overall susceptibility of the Pretty Eagle School well to potential contaminant sources is rated moderate to high.

Table 7. Susceptibility assessment for significant potential contaminant sources in the Inventory Region**.**

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
LUST NW of school building	VOC's, SOC's, inorganics	Contaminants leaching to groundwater	High	Continuous clay layer	High	Remove leaking tan remediate site, monit groundwater for contaminants
Cultivated cropland	Nitrates, pathogens, agchemicals	Nitrates, pathogens, & agchemicals leaching to groundwater	High	Continuous clay layer	High	Use best manageme practices & apply agchemicals accordi to labels
Large Capacity Septic System and Drainfield	Nitrates and pathogens	Nitrates and Pathogens leaching into groundwater	High	Continuous clay layer	High	Monitor groundwate ensure contaminants not impact PWS
Highway 331	All	Contaminants leaching to groundwater	Moderate	Continuous clay layer	Moderate	Implement an emergency respons plan
BIA Rd. 91 (secondary, little activity)	All	Contaminants leaching to groundwater	Low	Continuous clay layer, secondary road with low activity	Low	Implement an emergency respons plan
Abandoned and active septic systems	Nitrates and pathogens	Nitrates and Pathogens leaching into groundwater	Low	Continuous clay layer and low septic density	Low	Monitor groundwate ensure contaminants not impact PWS

REFERENCES

Cadmus Group, Inc., 2000, Sanitary Survey of Pretty Eagle School

Census Bureau, http://ceic.commerce.state.mt.us/C2000/PL2000/places90-2000.htm, http://ceic.commerce.state.mt.us/C2000/PL2000/places90-2000.htm, census information MT population http://ceic.commerce.state.mt.us/, census info MT economic and other information.

Heath, R.C., 1984, Introduction to State summaries of ground-water resources, U. S. Geological Survey Water-Supply Paper, p. 118-121.

Howard, A.D. and Williams, J.W., 1972, Physiography, in Mallory, W.W. (ed. in chief), Geological Atlas of the Rocky Mountain Region: Rocky Mountain Association of Geologists, Denver, CO, p. 29-31.

infoUSA Inc., Select Phone, version 2.2, (2002), <http://www.datadiscusa.com>

McNenny Environmental Engineering and Consulting, 1997, Sanitary Survey of Pretty Eagle School.

Montana Bureau of Mines and Geology, Ground-Water Information Center online database, http://www.mbmg.mtech.edu/

Montana DEQ, 2001, BacT database.

Montana DEQ, 1999, Montana Source Water Protection Program, Approved by EPA in November 1999. Montana DEQ Public Water Supply Program.

Montana DEQ Source Water Protection Program's Mapper GIS application, http://nris.state.mt.us/mapper/.

Montana DEQ, UST/LUST Data, http://www.deq.state.mt.us/rem/tsb/iss/USTDownloads.asp.

NRCS National Water and Climate Center, http://www.wrc.dri.edu/summary/climsmmt.html

Richards, P.W., Rogers, C.P., 1951, Geology of the Hardin Area, Big Horn and Yellowstone Counties, MT, Oil and Gas Investigations, Map OM 111, sheet 1.

Ross, Clyde P., Andrew, David A., Witkind, Irving, 1955, Geologic Map of Montana, Montana Bureau of Mines and Geology.

Sanborn Fire Insurance Company Maps, 1928, from original copies in the Geography and Map Division, Library of Congress; Series 588, reel 3, Sanborn Fire Insurance, Teaneck, N.J.

U.S. Department of Agriculture, Soil Conservation Service and United States Department of the Interior, Bureau of Indian Affairs in cooperation with Montana Agricultural Experiment Station, December 1977, Soil Survey of Big Horn County Area, Montana.

U.S. Environmental Protection Agency, Multisystem Database Query, http://www.epa.gov/enviro/html/multisystem_query_java.html

U.S. Environmental Protection Agency, Office of Water, 1991, Manual of Small Public Water Supply Systems, EPA 570/9-91-003, 211 p.

U.S. Environmental Protection Agency, Online Watershed Information, Hydrologic Unit Codes, http://cfpub.epa.gov/surf/huc.cfm?huc_code=10080015.

U.S. Geological Survey, 2000, National Landcover Dataset, Montana.

Vuke, Susan M., Wilde, E.M., Lopez, D.A., Bergantino, R.N., 2000, Geologic Map of the Lodge Grass 30’x60’ Quadrangle, Montana Bureau of Mines and Geology Map Series, No. 56.

GLOSSARY

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

Alkalinity. The capacity of water to neutralize acids.

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

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

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

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

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

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

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

Community. A town, neighborhood or area where people live and prosper.

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

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

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

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

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

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

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

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

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

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

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

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

Hydrologic Unit Codes (HUC). Uniform, nationally consistent map codes for river basins.

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

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). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

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

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

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

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

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

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

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

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

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

Public Water System. 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.

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

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

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

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

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

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

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

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

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

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.

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

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

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

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

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.

* With the exception of the definitions for Phase II and Phase V Rules, definitions were adapted from EPA’s Glossary of Selected Terms and Abbreviations which can be found at:
http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html

The definitions for Phase II and Phase V Rules were adapted from:
http://www.epa.gov/OGWDW/source/therule.html#PhaseII
http://www.epa.gov/OGWDW/source/therule.html#PhaseV

APPENDICES

APPENDIX A

FIGURES

APPENDIX B

SITE PLAN

APPENDIX C

WELL LOG(s)

APPENDIX D

SANITARY SURVEY

APPENDIX E

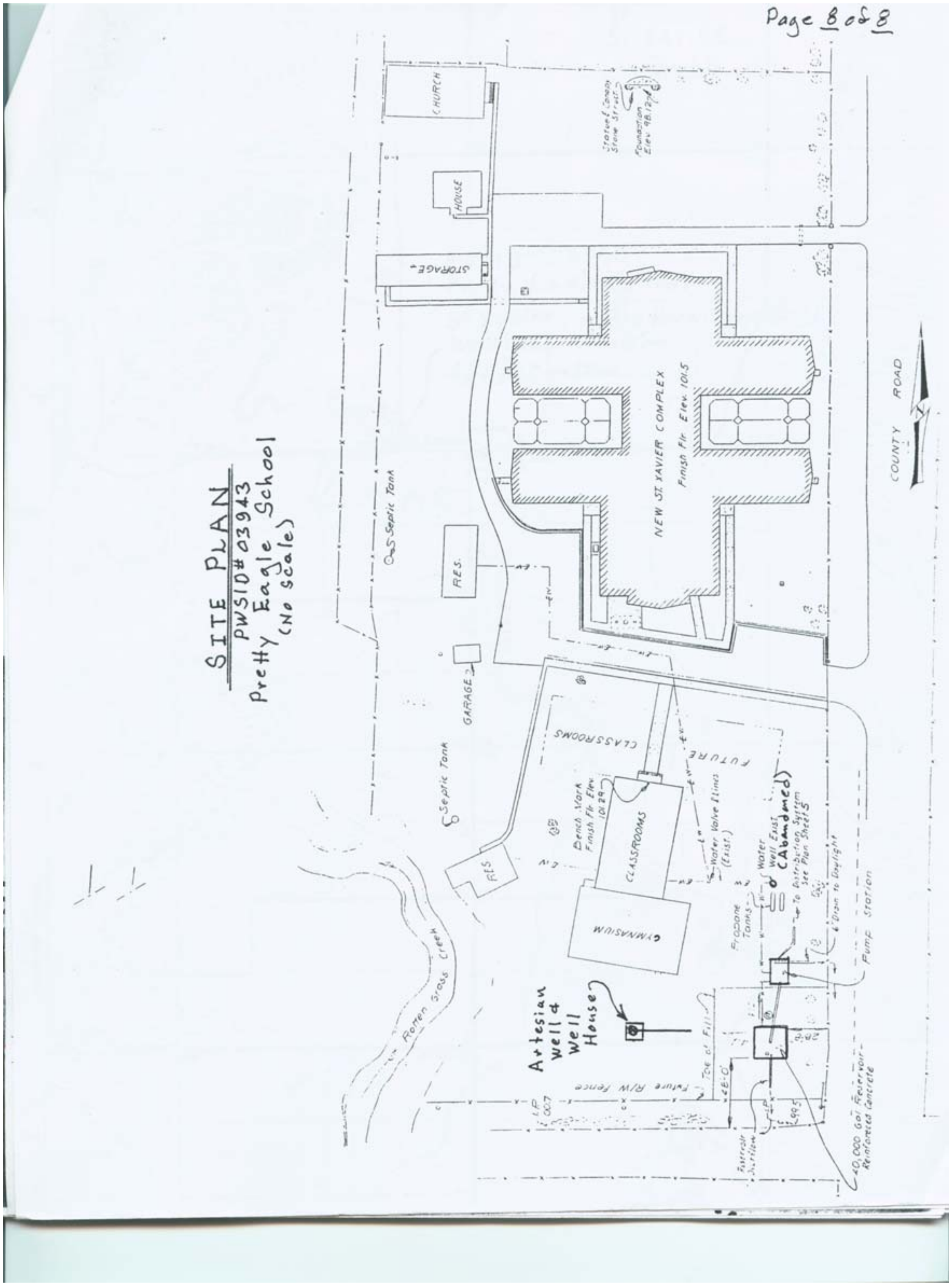
HAZARD AND BARRIER WORK SHEETS

APPENDIX A

FIGURES

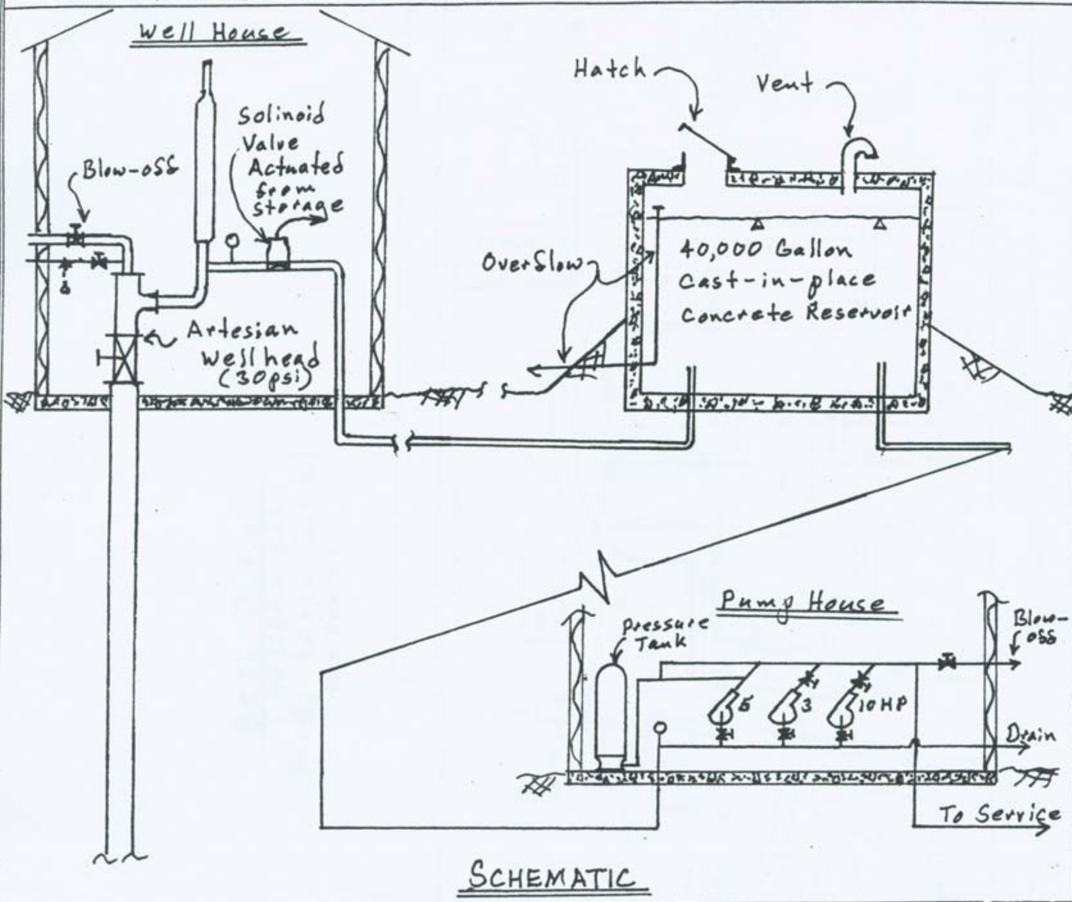
APPENDIX B

SITE PLAN


Page 8 of 8
SITE PLAN
PWSID# 03943
Pretty Eagle School
(No scale)
CHURCH
HOUSE
STORAGE
NEW ST. XAVIER COMPLEX
Finish Flr. Elev. 101.5
COUNTY ROAD
Septic Tank
RES.
GARAGE
CLASSROOMS
FUTURE
Bench Mark
GYMNASIUM
Water Valve 2 Lines (Exist.)
Water Well Exist.
(Abandoned)
To Distribution System See Plan Sheet 5
Propane Tanks
Pump Station
Artesian well & Well House
Rotten Grass Creek
Future R/W Fence
Toe of Fill
Reinforced Concrete

SANITARY SURVEY FORM - DIAGRAMS

Draw brief site plan showing location of well(s), springs(s), water storage, distribution system, pumphouse(s), entry point(s), treatment, etc.



Draw Brief schematic of placement of filters and disinfection equipment in relation to the source, entry point and distribution system below

APPENDIX C

WELL LOG

Montana Bureau of Mines and Geology
Ground-water Information Center Site Report
PRETTY EAGLE SCHOOL

Plot this site on a topographic map

Location Information

GWIC Id:	196431	Source of Data:	LOG
Location (TRS):	04S 32E 23 DCDD	Latitude (dd):	45.4615
County (MT):	BIG HORN	Longitude (dd):	-107.7265
DNRC Water Right:	105046	Geomethod:	MAP
PWS Id:	03943003	Datum:	1927
Block:		Addition:	
Lot:		Type of Site:	WELL
Certificate of Survey:	Not Reported		

Well Construction and Performance Data (measurements are reported below land surface)

Total Depth (ft):	47.00	How Drilled:	ROTARY/DRIVEN
Static Water Level (ft):	19.00	Driller's Name:	AMERICAN
Pumping Water Level (ft):	22.50	Driller License:	344
Yield (gpm):	100.00	Completion Date:	Apr 14, 1998
Test Type:	PUMP	Special Conditions:	
Test Duration:	8.00	Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):	19.00	Geology/Aquifer:	Not Reported
Recovery Time (hrs):		Well/Water Use:	PUBLIC WATER SUPPLY

Hole Diameter Information

From (ft)	To (ft)	Dia (in)
0.0	22.0	14.0
22.0	47.0	8.0

Casing Information

From (ft)	To (ft)	Dia (in)	Description
-1.5	37.0	8.0	A53-B STEEL
37.0	47.0	8.0	JOHNSON SCREEN

Annular Seal Information

From (ft)	To (ft)	Description
0.0	22.0	CEMENT

Completion Information

From (ft)	To (ft)	Dia (in)	Description
37.0	47.0	8.0	JOHNSON TELESCOPE SS SCRN

Lithology Information

From (ft)	To (ft)	Description
0.0	2.0	TOP SOIL
2.0	20.0	SAND/CLAY
20.0	22.0	CLAY
22.0	24.0	SAND
24.0	47.0	GRAVEL/SAND MIXED

Site Notes

TRACT LOCATION BASED ON LAT\LONG FROM DEQ.

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

APPENDIX D

SANITARY SURVEYS

Survey 1:

The Cadmus Group, December 11, 2000, Joe Steiner, surveyor.

Survey 2:

McNenny Environmental Engineering and Consulting, May 22, 1997, Darrell P. McNenny, surveyor.

APPENDIX E

HAZARD AND BARRIER WORKSHEETS

Pretty Eagle

Worksheet 2a.

Hazard Determination - Significant Potential Contaminant Sources for Wells

PWSID 03443003
Well ID 196431

Hazard	***High***	***Moderate***	***Low***
Time-of-Travel (years):	**<1**	**1-3**	**>3**
A. Animal Feeding Operations			
A1.			
A2.			
B. Wastewater Treatment, Spray Irrigation, Lagoons			
B1.			
B2.			
C. Spill Threat: Highway, Railway, or Pipeline			
C1. BIA Road 91 - Not a through road (low hazard)			
C2. Highway 313			
D. Underground Storage Tanks			
D1. LUST - Off NW corner of building			
D2.			
D3.			
E. Known Groundwater Contamination Sites			
E1.			
E2.			
E3.			
E4.			
E5.			
F. Other Significant Point Contaminant Sources			
F1.			
F2.			
F3.			
F4.			
F5.			
G. Injection Wells			
H. Sanitary Sewer Mains			
I. Storm Sewer Outflows			
Number / Sq. Mile:	***>300***	***50 - 300***	***<50***
J. Septic Systems (unsewered residential)			X
Percent:	***>50***	***20-50***	***<20***
K. Cropped Agricultural Land	25		

Pretty Eagle

Worksheet 3b.

Natural Barriers – Significant Potential Contaminant Sources

PWSID 03943003
Source 003
Number 196431

ID#	Facility Name	Barrier Type	Description
Wells	A – Continuous Clay Layer; B – Depth to Water > 100 ft.; C – Upward Gradient; D – Dilution; E - Natural Attenuation		
Surface Water	A - Dilution; B – Forested Riparian Zone > 50 ft.		
Significant Point Sources Including Underground Storage Tanks			
1	LUST - off NW corner of building	A C	
Ground Water Remediation Sites			
Animal Feeding Operations			
Wastewater Treatment, Spray Irrigation, Lagoons			
Spill Threat: Highway, Pipeline, or Railway			
2	BIA Rd 91 - Not a through road	A	
3	Highway 313 -	A	
MPDES Wastewater Discharges			
Injection Wells			
Sanitary Sewer Main			
Storm Sewer Outfall			
Septic Systems			
4	Low density	A	
Cropped Agricultural Land			
5	75%, high density	A	

Pretty Eagk

Worksheet 4

Susceptibility Assessment – Significant Potential Contaminant Sources

PWSID 03943003
Source 003
Mnumber 196431

Contaminant Source ID #	Hazard	Hazard Rating	Barriers	Susceptibility
1	VOC's, SOC's, inorgan leaching into GW	High	clay layer	High
2	VOC's, SOC's, inorganics leaching to groundwater	Low	Clay layer, secondary Rd. with little use	Low
3	VOC's, SOC's, inorganics	Moderate	Clay layer	Moderate
4	Pathagens + Nitrates	Low	Clay layer, low septic density	Low
5	Pathagens, Nitrates Ag chemicals	High	Clay layer	High