Source Water Delineation and Assessment Report (SWDAR)

Jim Darcy School District No. 1 Public Water Supply

Montana Public Water Supply ID# MT0001451

April 2003

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List of Acronyms

BMP - Best Management Practices

CAFO - Confined Animal Feeding Operation

CECRA - Comprehensive Environmental Cleanup and Responsibility Act

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

LUST - Leaking Underground Storage Tank

MCL - Maximum Contaminant Level

MBMG-GWIC - Montana Bureau of Mines and Geology – Ground Water Information Center

MPDES - Montana Pollutant Discharge Elimination System

NPDES - National Pollutant Discharge Elimination System

PWS - Public Water System.

RCRA - Resource Conservation and Recovery Act

SMCL - Secondary Maximum Contaminant Levels

SWDAR - Source Water Delineation and Assessment Report.

SWPP - Source Water Protection Plan

SWL - Static Water Level

SOC - Synthetic Organic Compounds

TMDL - Total Maximum Daily Load

UST - Underground Storage Tank

VOC - Volatile Organic Compounds

See glossary at end of text for definitions of acronyms and other terms used in this report

1.0 INTRODUCTION

The Safe Drinking Water Act (SDWA) Amendments of 1996 require states to develop and implement Source Water Assessment Programs (SWAP) to analyze existing and potential threats to the quality of the public drinking water supplies throughout the state. The Montana SWAP was formally approved by the US Environmental Protection Agency (EPA) in November 1999. The Montana SWAP was developed from the former Wellhead Protection Program, but includes surface water sources and requires a more rigorous inventory of potential contaminant sources. For communities that have already developed wellhead protection plans, SWAP revises these plans to meet the expanded requirements. DEQ also works with other groups such as Montana Rural Water Systems, Inc., and Midwest Assistance Programs to implement the program.

SWAP addresses only public water systems (PWS) regulated according to the Federal Safe Drinking Water Act. A public water supply system is defined, according to Federal and Montana regulations, as a system that supplies water for human consumption. A public water supply system has at least 15 service connections or regularly provides water to at least 25 persons daily for a minimum of 60 days in a calendar year. There are three types of public water supply systems:

- Community water systems provide water on a year-round basis, and have a minimum of 15 service connections or regularly serve at least 25 residents. In addition to incorporated towns, community systems may serve smaller areas such as housing subdivisions or trailer courts.
- Non-transient non-community systems do not serve communities, but provide water regularly to a minimum of 25 of the same people for at least 6 months of a year. These systems serve public buildings such as schools and hospitals, where people are employed but do not reside.
- Transient non-community systems do not serve communities, and do not regularly serve a minimum of 25 of the same people for at least 6 months of the year. These systems are usually seasonal, and are located in areas such as campgrounds and parks.

Source water protection is a common sense approach to guarding public health by protecting drinking water supplies. In the past, water suppliers have used most of their resources to treat water from rivers, lakes, and underground sources before supplying it to the public as drinking water. Source water protection means preventing contamination and reducing the need for treatment of drinking water supplies. Source water protection also means taking positive steps to manage potential sources of contaminants and contingency planning for the future by determining alternate sources of drinking water. Protecting source water is an active step towards safe drinking water; a source water protection program (along with treatment, if necessary) is important for a community's drinking water supply. A community may decide to develop a source water protection program based on the results of a source water assessment, which includes the delineation of the area to be protected and an inventory of the potential contaminants within that area.

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to help public drinking water supplies protect their water source from contamination. The Montana Source Water Protection Program is responsible for completing delineation and assessment reports for all public water supplies in Montana. The Source Water Delineation and Assessment Report (SWDAR) compiles the appropriate data and other technical information about an area to allow communities to develop source water protection plans. 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 identifying potential contaminant sources in delineated source water protection areas, and evaluating the potential for contamination of drinking water from these sources under "worst-case" conditions such as a flood, fire or human error. 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 Helena area communities and public water supply operators develop source water protection plans that meets their specific needs.

Scope and Purpose

This report presents the source water delineation and assessments for the public water supply for the Jim Darcy School located north of the City of Helena, in Lewis and Clark County, Montana. The Jim Darcy School is classified as a non-transient non-community public water supply. This report is intended to meet the technical requirements for the completion of the delineation and assessment report for this PWS, as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

This report addresses the public water supply area with a watershed-type approach, recognizing that potential contaminant sources may threaten more than one public water supply. The report presents information for the area near and upgradient from the PWS. This information will be used as a basis to develop SWDARs for additional public water supply sources in the area that have overlapping source water protection areas with similar threats.

Acknowledgements

This report was prepared by James Swierc with the University of Montana – Helena (UM-Helena) as part of a cooperative agreement with the Lewis and Clark Water Quality Protection District, using funding provided by the Source Water Protection Program of the Montana Department of Environmental Quality. Kathy Moore with the Lewis and Clark Water Quality Protection District provided support to completion of the report and project. The Helena Source Water Project was designed to evaluate all of the public water supplies in the Helena area. Inventory data for the project was researched and compiled by UM-Helena project interns Heather DeMangelaere and Marc Reeves, including completion of a “windshield” survey for the project. The operator for Jim Darcy School PWS, Mr. Heath Mason, provided valuable information on the operational status of the system.

Limitations

This report was prepared to assess threats to Jim Darcy School public water supply and is based on published information, and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to sources for regulated public water supplies, and not any other type of water supply. The inventory of potential contaminant sources focuses on the management areas delineated for the public water supplies in this report. As a result, other potential sources of contamination to surface and ground water in the area may not be identified.

The term "contaminant" is used in this report to refer to any chemical or biologic constituent in water that are listed as regulated under state and federal regulations. Water constituents are generally regulated based on health effects that may occur when ingested at certain levels. Water quality standards are based on maximum contaminant level goals (MCLGs) for a compound, which represents a concentration where adverse health effects are not considered likely to occur when ingested. However, as natural waters contain many dissolved constituents and MCLGs are frequently not attainable using economically viable water treatment alternatives, maximum concentration levels (MCLs) are used. MCLs represent concentrations that may result in chronic or acute health problems when ingested. MCLs are based on the relative risk, or likelihood that health problems may occur, and economics associated with a treatment technology for a specific constituent of water. In some cases, sources for constituents with Secondary MCLs are also evaluated in this report. Secondary MCLs are non-regulatory guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water.

2.0 BACKGROUND

The Community

Jim Darcy School is located north of the City of Helena. Helena is located in the southeastern part of Lewis and Clark County, in the southern part of the Helena Valley within the southern part of the Lewis & Clark County Water Quality Protection District as shown in Figure 1. The population of Helena was estimated at 25,780 people in the 2000 census, with an estimated total population of 40,000 people in the Helena Valley. Helena is the state capitol and considered a major Montana city as the primary place of employment for many residents within the Helena Valley and the region. The local economy is linked to the state government as a major employer in the area, with technical contractors and service industries supporting government functions. Many small businesses and a limited amount of industry are present in the valley. Agriculture is present in the area surrounding the developments outside of the greater Helena metropolitan area. Major industry in the area is located near central Helena and East Helena, south of the service area for Jim Darcy School. The primary roads through the area are I-15, which runs north-south through Helena, US 287 which connects Helena to the east and southeast, and US 12 which enters Helena from the west. Jim Darcy School is located on the north side of Lincoln Road, which runs east-west connecting the north part of the valley and I-15 with Lincoln to the northwest.

Wastewater in Jim Darcy School is collected and treated with a septic system. The City of Helena city municipal sanitary sewer system is present several miles south of Jim Darcy School. There are no municipal sewer systems located within the northern part of the Helena Valley. Areas outside of the Helena city limits are typically served by septic systems for wastewater treatment and disposal.

Geographic setting

Jim Darcy School is located at approximately 46.705º North latitude and 112.025º West longitude, in Section 18 of Township 11 North, Range 3 West. The Helena Valley is an intermontane basin in the Northern Rocky Mountains geographic province. The Helena Valley is bounded by the Big Belt Mountains to the east, the Scratch Gravel Hills to the west, the Elkhorn Mountains and Boulder Batholith to the south, and the “North Hills” to the north. The Jim Darcy School service area is located in the southern part of the North Hills area, in the northern part of the Helena Valley. The elevation of the Helena is approximately 3,800 feet above sea level, with the elevation of Lake Helena about 3650 feet, the lowest point in the valley. The elevation at the Jim Darcy School is approximately 3765 feet above seal level. The elevation of the mountains surrounding Helena rise as high as 9,000 feet above sea level.

All surface water in the Helena Valley flows towards Lake Helena, which discharges into Hauser Reservoir damned on the north flowing Missouri River (USGS HUC#100300101) in this area. Surface flow in the Jim Darcy School area is generally to the east, following topography. Silver Creek (USGS HUC#100300101140) with headwaters near the continental divide flows from the Marysville area in the western part of Lewis and Clark County eastward through the Helena Valley. Silver Creek flows south of the Jim Darcy School service area, with water flow

***Figure 1* – Jim Darcy School Location**

related to the local ground water systems as discussed later in this document. Prickly Pear Creek (USGS HUC#100300101120) flows from a watershed in the Elkhorn Mountains and Boulder Batholith south of Helena northward through East Helena into the valley. Tenmile Creek (USGS HUC#100300101130) enters the Helena Valley from the southwest, south of the Scratch Gravel Hills with a watershed adjacent to the continental divide in the southwest corner of Lewis and Clark County. The Helena Valley Irrigation Canal flows in a clockwise direction around the outside of the Helena Valley, from the Helena Regulating Reservoir.

The climate in the area is typical for southwestern Montana. Weather data is reported for Helena, from a weather station near the Airport. Data for Helena is available from 1893 to 2001. Helena receives an average of 11.99 inches of precipitation annually, with the wettest months in May and June averaging 1.92 and 2.10 inches. The driest months are November through February, with averages between 0.48 and 0.62 inches per month. Helena receives an average total of 51.3 inches of snowfall per year. The temperature ranges from an average high of 82.4º F in July (minimum July average of 53.3º F) to an average of 29.5º F in January (minimum January average of 11.1º F).

General description of the Source Water

Jim Darcy School obtains water from one well (Source WL 002). The service area comprises the school. The well is located within the northwest of the school building. The well is installed into Helena Valley alluvium. The Helena Valley alluvium combined with underlying Tertiary Sediments (present in the central and eastern part of the valley) are considered as a regional unconfined aquifer comprising the valley fill sediments of the Helena Valley. Ground water flow in the Jim Darcy School area is generally to the southeast, towards the lowest elevation of the valley in Lake Helena. Silver Creek flows eastward through the area, and the Helena

***Figure 2* – North Helena Valley and Silver Creek Watershed**

Valley Irrigation Canal flows eastward north of the Jim Darcy School area. Water flow in Silver Creek responds to seasonal changes in ground water elevation. The aquifer is recharged from stream loss in the Helena Valley Irrigation Canal, stream loss from Silver Creek as it crosses from bedrock to alluvium in the Helena Valley, from the discharge of bedrock aquifers from the Scratch Gravel Hills into the alluvial aquifer in the subsurface, and from infiltration of precipitation. The Silver Creek watershed, considered as the recharge area for the aquifer for this assessment, is located northwest of Helena as depicted in Figure 2.

The Public Water Supply

Jim Darcy School PWS serves an estimated population of 320 residents though one service connections and one well. The PWS service areas incorporates the school facilities. The well is located north of the kitchen, in the central part of the school property as shown in Figure 3. The water is pumped directly into the school building. Water from the well is pressurized with air tanks into the distribution system. The sanitary survey for the system (Appendix A) indicate a sand filter system for the water is the only treatment. Well logs from the MBMG-GWIC database for the PWS well and other wells in the area are included in Appendix B. The well log indicates that the PWS well was installed in December 1965 to an approximate depth of 86 feet below ground surface with perforations from 60 to 66 feet and 72 to 78 feet.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring parameters typically include coliforms (as an indicator of pathogenic organisms), nitrates, metals and multiple chemicals. The monitoring schedule depends on many factors such as the size of the system, the water source for the PWS, the number of sources (e.g. wells), and land use in the area. A specific monitoring program is designed for each PWS that follows the general protocols for operation of a PWS defined by DEQ following the guidelines originally established in the federal Safe Drinking Water Act. A review of the DEQ PWS database of monitoring results for Jim Darcy School PWS indicates several missed sampling intervals, but does not indicate any monitoring violations based on exceedences of drinking water standards during the past few years (Appendix A).

Water quality data for the Helena area was obtained electronically from the Montana Bureau of Mines and Geology (MBMG) database (GWIC – see Appendix C). Table 1 lists the data for the sections upgradient and proximal to Jim Darcy School PWS Wells. This data is considered to represent background concentrations for ground water near the PWS sources. One sample indicated a detection of Mercury at elevated concentrations. Mercury is known to be present in Silver Creek from historical placer mining activities. The presence of Mercury in the aquifer is considered unlikely, as Mercury is not water soluble and typically does not migrate into ground water systems. However, the presence in this sample does indicate the possibility. The GWIC database for the Helena Valley area near Jim Darcy School is included in Appendix C.

***Figure 3* – PWS Well Location**

Ongoing studies by the WQPD and USGS indicate that elevated levels of nitrates are found in ground water downgradient from subdivisions with high concentrations of septic systems in the northern Helena Valley (Appendix C). During the past few years, multiple residents have reported well yield has diminished during the past several year, resulting in many long-term residents installing new, deeper wells. In response to the apparent reduced yield from the aquifer and elevated nitrate levels, DNRC temporarily classified the North Hills area as a controlled ground water area. This classification limits the installation of new wells except for replacement of an existing well. The final classification has not been determined by DNRC at the time of preparation of this report.

Table 1 – Background Water Quality in Jim Darcy School Area

Site Location Data

Site Name	Twn	Rng	Sec	Q Sec	Type	Depth (ft)	Sample Date	Lab PH	Lab SC
Silver Creek	11N	04W	14	DCCA	Well	112	8/10/90	7.42	351.8
LCWQPD – North Hills Well	11N	03W	7	BCDA	Well	100	11/28/01	7.71	364
LCWQPD – North Hills Well	11N	03W	7	BCDA	Well	100	11/28/01	7.58	405
State of Montana – Dept. of State	11N	03W	8	BCBA	Well	208	10/31/90	7.86	404.9
LCWQPD – Gravel Pit Well	11N	03W	18	CCCC	Well	100	11/28/01	7.7	676
LCWQPD – Gravel Pit Well	11N	03W	18	CCCC	Well	100	11/28/01	7.54	685

Anion/Cation and Nutrient Data

Site Name	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Fe mg/l	Mn mg/l	SiO2 mg/l	HCO3 mg/l	SO4 mg/l	Cl mg/l	NO3 mg/l	F mg/l	OPO4 Mg/l	TDS mg/l
Silver Creek	115	43.69	32.42	4.56	<.004	<.002	24.5	389	188	12.8	0.47	0.24	*Nl*	613.5
LCWQPD – North Hills Well	39.8	15.8	14.2	0.977	0.025	<.001	16.2	109.8	17.8	7.11	0.97	0.214	<.05	*Nl*
LCWQPD – North Hills Well	40.7	16.2	14.5	0.955	0.008	<0.001	15.3	208.6	16.5	6.45	0.787	0.219	<.05	*Nl*
State of Montana – Dept. of State	44.5	12.5	16.4	1.71	0.004	0.004	17.1	162	29.9	23.5	1.2	0.27	<.1	*Nl*
LCWQPD – Gravel Pit Well	68.8	21.2	31	2.7	0.033	<.001	10.7	152.3	81.4	93	3.84	<.5	<.5	*Nl*
LCWQPD – Gravel Pit Well	67	19.9	31.8	2.57	0.015	<0.001	9.81	141.5	98.8	77.7	3.7	0.05	<0.05	*Nl*

Metals Data

Site Name	Ag ug/l	Al ug/l	As ug/l	B ug/l	Ba ug/l	Br ug/l	Cd ug/l	Cr ug/l	Cu ug/l	Li ug/l	Mo ug/l	Ni ug/l	Pb ug/l	Sr ug/l	Ti ug/l	U ug/l	V ug/l	Zn ug/l
Silver Creek	<4.	190	*NL*	52	181	<100	<5.	<5.	<4.	16	<40.	<20.	*NL*	308	6	*NL*	<4	<6.
LCWQPD – North Hills Well	<1	<30	<1	<30	107	<50	<2	<2	<2	7.95	<10	2.07	<2	252	<1	1.93	<5	2.91
LCWQPD – North Hills Well	*NL*	<30	<10	<30	113	<50	<1	<10	<5	7.81	<10	<2	<10	240	<1	*NL*	<10	<2
State of Montana – Dept. of State	7	147	*NL*	<40.	132	<100.	<5.	9	7	10	<40.	<20.	*NL*	261	14	*NL*	11	77
LCWQPD – Gravel Pit Well	<1	<30	2.15	<30	96.1	<500	<2	<2	<2	5.51	<10	3.59	<2	224	<1	1.34	<5	276
LCWQPD – Gravel Pit Well	*NL*	<30	<10	<30	95.5	460	<1	<10	<5	5.03	<10	<2	<10	193	<1	*NL*	<10	6.31

NL = Not listed in Database

3.0 HYDROGEOLOGIC SETTING AND DELINEATION

The source water protection area, the land area that contributes water to Jim Darcy School PWS, is identified in this chapter. For the PWS source, three management areas are identified within the source water protection area; the control zone, inventory region, and recharge region. Since the source aquifer is unconfined and ultimately recharged by surface water, a surface water buffer zone is delineated around the Helena Valley Irrigation Canal upgradient from the inventory zone.

The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region for the well is delineated based on a three-year time of travel distance for ground water to the sources. The recharge region represents the area where the aquifer is replenished. The surface water buffer zone represents the area of a one-half mile wide buffer on each side of a surface water body, for a distance of ten miles upstream from the PWS source.

Hydrogeologic Conditions

The information presented in this section is based predominantly on the assessments of the hydrogeology of the area performed by the United States Geological Survey (USGS) and Montana Bureau of Mines and Geology (MBMG). This includes a study of the Helena Valley alluvial aquifer presented in Briar and Madison (1992), and Bedrock Aquifers in the Helena Area presented in Thamke (2000). A geologic map of the Silver Creek Watershed Region showing the major units is depicted in Figure 4.

Ground water in the Helena Valley is present in an unconfined alluvial aquifer. The Helena Valley is a structural basin with bedrock boundaries. The central part of the valley is filled with up to 6,000 feet of sediments derived from the bedrock in the area. The valley is filled with a thick sequence of interlayered fine and coarse grained Tertiary sediments; overlain by up to 100 feet of Quaternary alluvium. The Tertiary beds and the alluvium are considered as a single aquifer in the area. In the area near the Jim Darcy School northeast of the Scratch Gravel Hills, and south of the North Hills, the alluvium is present directly over either granitic bedrock or shales of the North Hills. Tertiary pediment surfaces are present in various areas along the margins of the valley, and may be considered part of the alluvial aquifer when present in sufficient thickness to represent a water bearing unit. .

Ground water in the area near Jim Darcy School generally flows to the southeast, following the direction of surface topography towards Silver Creek, and ultimately towards Lake Helena. There are some local variations in this general flow direction due to changes in local conditions. A potentiometric surface map showing the general direction for ground water flow in the area is presented in Figure 5. Water flow in the alluvium is primarily horizontal, with vertical hydraulic conductivities generally 1-3 orders of magnitude less (Briar and Madison, 1992). Recharge to the alluvial aquifer occurs from stream loss along the valley margins, direct infiltration of precipitation, leakage from irrigation canals, and from direct infiltration of water from bedrock aquifers in the subsurface. The depth to ground water in the area ranges from approximately 20 to 40 feet below the ground surface, and varies during the year.

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. For Jim Darcy School PWS, water is obtained from an unconfined alluvial aquifer. A generalized cross section depicting the geology is shown in Figure 6. Ground water flow is generally to the southeast, following topography. Recharge to the aquifer occurs from stream loss from Silver Creek and the Helena Valley Irrigation Canal, infiltration from precipitation, and from the bedrock in the Scratch Gravel Hills along the western margin of the valley and the North Hills of the valley. The unconfined alluvial aquifer is considered to have a high source water sensitivity to contamination.

Well Information

The well for Jim Darcy School PWS is located north of the Helena city limits as depicted in Figure 3. The well log with stratigraphy and well construction information is included in Appendix B. Well information is summarized in Table 2.

Table 2 - Source Well Information for Jim Darcy School

Information	Well 2
PWS Source Code	002
Well Location	T11N, R3W, Sec 18 DDCC
	Lat 46.7049 N Long 112.0256 W
MBMG/GWIC #	64880
Water Right #	W090085
Date Completed	1 December 1965
Total Depth	86 feet
Perforated Interval	60 – 66 feet, 72 – 78 feet
Static Water Level	16 feet
Pumping Water Level	20 feet
Drawdown	4 feet
Test Pumping Rate	100 gpm
Specific Capacity	25 gpm/ft

Methods and Criteria

The methods and criteria used to delineate the source water protection zones for Jim Darcy School water system are specified in the Montana Department of Environmental Quality Source Water Protection Program (DEQ, 1999). The criteria for unconfined aquifer systems was applied. The control zone was established using a fixed radius of 100 feet around the wellhead. The inventory zone was delineated based on a ground water time of travel distance of three years. This distance was determined using a simple ground water flow model using the uniform flow equation (EPA, 1991). Conservative estimates for aquifer properties were made using available data from published reports, as discussed in the following. The inventory zone for the well was broadened to reflect potential changes in the flow system during seasonal periods of high and/or low flow. The recharge area for the alluvial aquifer is considered to be the entire Silver Creek Watershed above Jim Darcy School (Figure 2). A surface water buffer zone is delineated around Silver Creek based on a standard distance criterion of ten miles upstream from the well, with the buffer encompassing the land area of one-half mile width on each side of the stream.

Model Input

The values selected for the calculation of time of travel represent conservative assumptions made to identify areas that may potentially impact the Jim Darcy School PWS source. The values for aquifer properties are based on published information characterizing the regional aquifer system (Briar and Madison, 1992). The criteria for selection of the values used for the delineation of the inventory zone are as follows:

***Figure 4* – Generalized Geologic Map of Study Area**

***Figure 5* – Generalized Potentiometric Surface Map, Helena Valley Aquifer**

***Figure 6* – Generalized Geologic Cross Section, Helena Valley Aquifer**

Well Model Values:

- ***Thickness***: The value for the thickness of the aquifer (b) is estimated at 50 feet, based on the estimated thickness of the screened part of the aquifer, and the depth to ground water from well logs.
- ***Hydraulic Conductivity***: A hydraulic conductivity value of 100 feet/day is used, based on information from Briar and Madison (1992)
- ***Transmissivity***: The transmissivity value for the alluvium is estimated at 5,000 ft^2/day based on the relationship T = K*b.
- ***Hydraulic Gradient***: The hydraulic gradient was measured from the potentiometric surface map in Briar and Madison (1992) shown in Figure 5. The gradient shows an approximate value of 0.015.
- ***Flow Direction***: The flow direction is considered southeast, based on the map of Briar and Madison (1992).
- ***Porosity***: The value for effective porosity for the alluvium is estimated from (Todd, 1980) at 30%. The estimated value is considered representative of medium to coarse grained gravel.
- ***Pumping Rate***: The pumping rate for the wells was estimated at 50 gpm, which is a conservative estimate reflecting the needs of the system.

Delineation Results

The results of the calculations for the alluvial aquifer to the wells indicate an estimated distance of 1,920 feet (0.36 miles) for a one-year time of travel (TOT), and a distance of 5,585 feet (1.06 miles) for a three-year TOT. A summary of the time of travel calculations is included in Appendix D. The delineated inventory zone for the well is depicted in Figure 7.

The inventory zone comprises the alluvium present northwest of the well. The western portion of the inventory zone reflects the recharge to the aquifer from the Helena Valley Irrigation Canal, and the southeastern component to shallow ground water flow. A surface water buffer zone is delineated around the Helena Valley Irrigation Canal upstream from where the stream crosses the inventory zone for the well. The recharge region is considered to be the Silver Creek Watershed area shown in Figure 2.

Limiting Factors

The interaction of surface water between the alluvial aquifer, Silver Creek and the Helena Valley Irrigation Canal is not well understood at this time due to the limited amount of data on the system. In particular, the changes in the flow regime under seasonal conditions of high and low flow are not known. The delineation was completed using conservative assumptions to help ensure that the inventory zone reflects the actual area where contamination to the system may occur. In all cases, the interpretations and conclusions on ground water flow in the aquifer(s) are based on general principles of hydrogeology, and the physical mechanics of ground water flow.

Figure 7 – Delineated Source Water Protection Management Areas

4.0 INVENTORY

An inventory of potential sources of contamination was conducted for Jim Darcy School PWS source within the control and inventory zones. Potential sources of all primary drinking water contaminants, including pathogens, were identified. However, only significant potential contaminant sources based on criteria outlined in the Montana Source Water Protection Program (DEQ, 1999) were selected for detailed inventory. The inventory for Jim Darcy School PWS focuses on all activities in the control zone, certain sites or land use activities in the inventory zone, and general land uses and large facilities in the recharge region. The inventory results from the various steps (Appendix E) are summarized in Table 4. The significant potential contaminants in the inventory region for the wells includes nitrates and pathogens from septic systems and agriculture; and herbicides and pesticides from cropped agricultural land.

Inventory Method

The initial inventory steps comprise querying existing state and federal electronic databases for regulated facilities that use, store or release regulated chemicals. The steps to the database searches, and the results from each step are listed in Appendix E. The assessment of agriculture land use and urban areas, and major transportation routes through the area are shown on Figure 8. The limits of the municipal sewer system and relative density of septic systems in the area are shown on Figure 9. The database search is supplemented and verified with a "windshield survey" and a business directory search of the delineated inventory zones for each PWS in the study area. The results of the business directory search are included in Appendix E. This method helps ensure the inventory is a complete data collection exercise to identify all potential contaminant sources.

The results of the inventory process are summarized in Table 3, which summarizes the properties or sites within the inventory zone study area. The potential contaminants are listed, with a description of the potential release mechanism for the site. In all cases, releases may occur due to unavoidable conditions such as flooding, lightning or fire. The sites where this is the primary potential release mechanism are identified as concerns resulting from such a disaster. For other sites where other release mechanisms may be more common, the potential for a release from such a disaster is assumed.

The results of the "windshield survey" were consistent with the results from database searches, and did not indicate any additional facilities to review. Storm water flows into drainage ditches through the area. While not observed in this area, storm water drains that discharge into infiltration galleries represent injection wells of surface water into shallow ground water. Class V injection wells are classified as waste disposal conduits that discharge directly to shallow ground water. The evaluation of the use of Class V injection wells in Montana is currently the responsibility of the EPA.

The Montana Source Water Protection Program identifies specific types of potential contaminant sources as significant, for further evaluation of the susceptibility of the water source to these sources. The following categories of potential contaminant sources are considered significant:

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

Inventory Results/Control Zone
The control zone represents the most critical point to protecting the integrity of a wellhead for ground water sources. The control zone for the well is located within an open area, with no fencing or other limit to direct access to the wellhead. Part of the inventory zone is located within the school building. Potential contaminant sources within the control zone include lawn maintenance chemicals and/or fertilizers.

Table 3 - Summary of Inventory Results for Jim Darcy School PWS.

Source Type	*Potential Contaminants*	*Description/Concern*
Step 1 Results		
Agricultural Land Use	*Pathogens and Nitrates; Pesticides and Herbicides*	*Non-point source pollution, concentration of fertilizers/chemicals in surface/ground water*
Urban Land Use	*Spills of various chemicals*	*Non-point source pollution, small spills of household chemicals*
Septic Systems	*Pathogens and Nitrates*	*Non-point source pollution, loading o f ground water system with effluent*
EPA Envirofacts Sites (Step 2)	*No Sites identified*	
EPA-PCSs Sites (Step 3)	*No sites identified*	
DEQ Database (Step 4)		
UST/LUST Sites	*No sites identified*	
CECRA Sites	*No sites identified*	
Business – SIC Code Sites (Step 5)	*No sites identified*	
Miscellaneous Others, including Step 6		
Major Roads	*Spills of various chemicals*	*Disaster – spill/release of chemicals and fuels transported on Highway*
Railroad Lines	*Spills of various chemicals*	*Disaster – spill/release of chemicals and fuels transported on railroad line*
Gravel Pit – Lewis and Clark County	*Various chemicals*	*Disaster – spill/release of chemicals and fuels with direct access to aquifer.*
RV Park	*Pathogens and Nitrates, Fuel Chemicals*	*Accidental spill or release of septic waste, or accidental release of fuels*
Class V Injection Wells	*Various chemicals*	*Direct discharge of chemical to shallow ground water system*

* Note: Sites identified from multiple search queries are listed with the first step that identified the specific site. Individual sites identified are evaluated in Chapter 5.

Inventory Results/Inventory Region
The inventory region represents the area near the source well where any contamination spilled onto the ground or subsurface has the potential to migrate directly into the PWS source aquifer. A summary of the inventory results of significant potential contaminant sources are listed in Table 4. Completed inventory summary sheets for the significant potential contaminant sources are included in Appendix F.

The inventory region for the well is the area upgradient from the wellhead, defined by the distance ground water will travel to the well in three years. Land use in this area is classified as predominantly non-urban and agricultural. The identified potential contaminant sources include the agricultural land use, roads, and septic tanks.

Inventory Results/Surface Water Buffer Zone
The surface water buffer zone is the area of one half mile on each side of the surface water bodies for a distance of ten miles upstream from the PWS sources. The delineated area is part of the Helena Valley Irrigation Canal is shown in Figure 7. The inventory of the surface water buffer zone focuses on potential contaminants with acute health risks, such as pathogens or nitrates. The delineated zone includes part of the City of Helena Sewer System service area, and areas with septic systems and agricultural development with related potential contaminants.

Inventory Results/Recharge Region
The recharge region for the wells is the Silver Creek Watershed. The Silver Creek Watershed is currently closed for fishing due to Mercury present in the streambed from historical placer mining. The watershed includes multiple closed and/or abandoned mines, including the mines from the Marysville Mining district. The primary potential contaminant source(s) are from closed and/or abandoned mines which represent sources of heavy metals to the environment. The area within the watershed is predominantly national forest land, with limited agriculture.

Table 4. Significant potential contaminant sources for Jim Darcy School PWS.

Source	*Contaminants*	*Description*
Agricultural Land Use	*Pathogens and Nitrate; Pesticide/Herbicides (SOCs)*	*Primary concern in cultivated and grazing lands in Tenmile Creek watershed upstream from wells.*
Septic Systems	*Pathogens and Nitrate*	*Area around the wells with moderate density, within well inventory zone. Additional areas are present within the Surface Water Buffer Zones*
Storm Water Discharge Points	*Various organic chemicals*	*Not inventoried at this time*
Major Roads	*Various Chemicals*	*Transportation corridors near PWS, concern over an accident and spill of any transported chemicals*
Class V Injection Wells	*Various organic chemicals*	*Not inventoried at this time (EPA responsibility); may provide conduits for chemicals into subsurface*

Inventory Update
The certified operator for Jim Darcy School PWS will update the inventory 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 inventory is limited by the accuracy of information in databases used for the assessment. The windshield survey provides a level of quality assurance that the information presented reflects current conditions at the time of preparation of this report. The location of Class V injection wells is not complete at this time, and is currently being compiled by EPA for the area. The data from the MBMG-GWIC database on wells in the area may not be complete, as not all wells are included in the database.

***Figure 8* – Land Use Classification**

***Figure 9* – Septic System Density and Limits of City Sewer Area**

5.0 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 Jim Darcy School PWS.

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 Jim Darcy School PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to Jim Darcy School PWS source (Table 5). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 7).

Table 5 - 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

For point sources, the relative hazard for the potential contaminant sources is assigned based on the type of aquifer. For unconfined aquifers, the relative hazards for point source are based on the location of the potential contaminant source relative to the well. Potential sources within a one-year time of travel distance to the well are assigned a relative hazard of high. Potential contaminant sources located between a one-year and thee-year time of travel distance are assigned a relative hazard of moderate. Any other potential contaminant sources within the recharge area are assigned a relative hazard of low.

After the relative hazard of a potential contaminant source is assigned, the relative susceptibility is determined based on the presence of barriers that may mitigate the potential for a contaminant source to impact a water source. Barriers may represent natural conditions, engineered barriers or management actions. Natural barriers include anything that can be demonstrated as effective in mitigating the migration of any chemicals released at the surface, such as thick clay-rich soils or surface flowing artesian conditions. Engineered barriers represent man-made structure to contain chemicals if they are released, such as spill containment for underground storage tanks. Management barriers are plans that prohibit or control potentially polluting activities, but only if there is a plan or approach that has been formally implemented.

For Jim Darcy School PWS sources, no natural barriers were identified present due to the coarse grained and highly transmissive nature of the source aquifer.

For non-point sources, the relative hazard is assigned based on the relative concentrations present within the delineated inventory zone for the aquifers, following the criteria listed in Table 6.

Table 6 – Relative Hazards for Non-Point Potential Contaminant Sources

Source Type	***High Hazard***	***Moderate Hazard***	***Low Hazard***
Septic Systems	> 300 per sq. mi.	50 – 300 per sq. mi.	< 50 per sq. mi.
Municipal Sanitary Sewer (% Land Use)	> 50% of region	20% – 50% of region	< 20% of region
Cropped Agricultural Land (% Land Use)	> 50% of region	20% – 50% of region	< 20% of region

Susceptibility Assessment Results

The results of the susceptibility assessment for Jim Darcy School PWS are listed in Table 7. The primary threats identified within the one-year time of travel distance are agricultural land use and areas with concentrated numbers of septic systems. The location of the railroad tracks and roads within the area all represent potential threats with a very high susceptibility rating, where an accidental spill or leak could impact water quality in the source aquifer.

The summary information in Table 7 reviews the relative hazard, barriers and susceptibility ranking of each potential source. Management alternatives are recommended that can help reduce the relative susceptibility of each identified potential contaminant source to the PWS sources.

Table 7. Susceptibility assessment of significant potential contaminant sources.

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Inventory Zone						
Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Moderate	None	High	Promote the use and development of agricultural BMPs for the area
Septic Systems	Pathogens and Nitrate	Infiltration and Runoff	Moderate	None	High	Monitor septic system performance
Large Capacity Septic System Serving School	Pathogens and Nitrate	Infiltration	High	Pressure Dosed	High	Monitor septic system performance
Major Roads	Various Chemicals	Spills	High	None	Very high	Develop emergency response plan
Surface Water Buffer Zone						
Cropped Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Low	None	Moderate	Promote the use and development of agricultural BMPs for the area
Septic Systems	Pathogens and Nitrate	Infiltration and Runoff	Low	None	Moderate	Monitor septic system performance
City of Helena Sewer System	Pathogens and Nitrate	Infiltration and Runoff	Low	None	Moderate	Monitor septic system performance
Recharge Area						
Silver Creek and mine sites	Metals	Infiltration and Runoff	Low	None	Moderate	Monitor progress of superfund remediation of area
Cropped Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Low	None	Moderate	Promote the use and development of agricultural BMPs for the area
Septic Systems	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	Low	None	Moderate	Monitor septic system performance

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