The Buzz Inn
Public Water Supply

Source Water Delineation and Assessment Report (SWDAR)

Public Water Supply ID# MT0000592

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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 East 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 The Buzz Inn located east of East Helena, in Lewis and Clark County, Montana. 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 East Helena area with a watershed-type approach, recognizing that potential contaminant sources may threaten more than one public water supply. The report presents all of the information for the East Helena area, and 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 East Helena Source Water Project was designed to evaluate all of the public water supplies in the East Helena area. Inventory data for the project was researched and compiled by UM-Helena project intern April Navarro. UM-Helena interns April Navarro and Scott Smith conducted the “windshield” survey for the project. The representative for The Buzz Inn PWS, Ms. Laurie A. Davis, provided valuable information on the operational status of the system.

Limitations

This report was prepared to assess threats to The Buzz Inn 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

The Buzz Inn is located adjacent to the eastern part of the City of East Helena. East Helena is located in the southeastern part of Lewis and Clark County, in the southern part of the Helena Valley within the southeastern part of the Lewis & Clark County Water Quality Protection District. The population of East Helena was estimated at 1,642 people in the 2000 census. East Helena is located approximately five miles east of Helena, and serves as a bedroom community to the Helena area, as many residents of East Helena work at locations across the valley. East Helena has multiple small businesses, with a limited amount of industry. A limited amount of agriculture is present in the area surrounding East Helena. Major industry in East Helena formerly included the ASARCO smelter, which recently closed in operation; and the American Chemet Company. The Buzz Inn is located north of Highway 12, adjacent to the eastern city limits of East Helena.

Wastewater in The Buzz Inn is collected and treated with septic systems. The East Helena city municipal sanitary sewer system is present west of The Buzz Inn. The East Helena sewer system pumps to treatment lagoons located north of town. The East Helena wastewater lagoons discharge into the Prickly Pear Creek at a location due west of the treatment lagoons. Areas outside of the city limits are typically served by septic systems. Residences outside of the city limits use individual septic systems for wastewater treatment and disposal.

Geographic setting

The Buzz Inn is located at approximately 46.587º North latitude and 111.899º West longitude, in Section 31 of Township 10 North, Range 2 West. The East Helena area is located at the southern end of the Helena Valley, with the Elkhorn Mountains located approximately 5 miles south of town. The Big Belt Mountains are located on the east side of the valley, with smaller hills and mountains located around the remaining sides of the valley (Figure 2). Prickly Pear Creek (USGS HUC#100300101120) flows from a watershed south of East Helena northward through town towards Lake Helena, the lowest elevation in the Helena Valley. Prickly Pear Creek flows west of The Buzz Inn. All surface water in the Helena Valley flows towards Lake Helena, which discharges into Hauser Reservoir behind a dam to the north flowing Missouri River (USGS HUC#100300101) in this area. The elevation of the town is 3,980 feet above sea level. The elevation of the Elkhorn Mountains rise as high as 9,000 feet above sea level in the upper reaches of the Prickly Pear Creek Watershed. Surface drainage in East Helena generally flows north. Several irrigation ditches, including water derived from Prickly Pear Creek, are present in the area.

Figure 1 – East Helena Location

The climate in the area is typical for southwestern Montana. Weather data is reported for Helena, located five miles west of East Helena. 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. East 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
The Buzz Inn obtains water from two wells (Sources WL 002 and WL003) located on the eastern part of the property. The trailers are located along the western part of the property, and the eastern area is used as a seasonal RV Park. The wells are installed through Helena Valley fill alluvium into the upper part of a sequence of Tertiary sediments. The two units together are considered as a regional unconfined aquifer comprising the valley fill sediments of the Helena Valley. Ground water flow in the East Helena area is generally northward, to the lowest elevation of the valley in Lake Helena. Prickly Pear Creek flows northward through the East Helena area. Water flow in Prickly Pear Creek responds to seasonal changes in ground water elevation. The aquifer is recharged from stream loss in Prickly Pear Creek as it crosses from bedrock to alluvium in the Helena Valley; from the discharge of bedrock aquifers into the alluvial aquifer in the subsurface, and from infiltration of precipitation. The Prickly Pear Creek watershed, considered as the recharge area for the aquifer for this assessment, is located in the Elkhorn Mountains, as depicted in Figure 2.

The Public Water Supply
The Buzz Inn PWS serves an estimated population of 48 year-round residents, and 40 transient persons per day in the summer, and 10 per day in the winter. The system has 24 permanent residential connections, and 21 transient connections in the RV Park area. The location of the two sources for the system and the limits of the property are shown in Figure 3. Well 1 is located in the laundry building east of the RV Area. Well 2 is located northwest of Well 1, in an open area behind several buildings. A copy of the most recent sanitary survey for the system is included in Appendix A. Water from each well is pressurized with air tanks directly into the distribution system. The sanitary survey for the system (Appendix A) does not indicate any treatment for the water. There are no available well logs listed in the MBMG-GWIC database, and there is no well information included with the most recent sanitary survey. Well logs from the MBMG-GWIC database for other wells in the area are included in Appendix B.

Figure 2 – Helena Valley and, Prickly Pear Creek Watershed

Figure 3 – PWS Well Locations

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 The

Buzz Inn PWS indicates several monitoring violations during the past few years. There were no significant violations of any drinking water quality standards based on detections of regulated contaminants (Appendix A).

Water quality data for the East Helena area was obtained electronically from the Montana Bureau of Mines and Geology (MBMG) database (GWIC). Table 1 lists the data for the sections upgradient and proximal to The Buzz Inn PWS Wells. This data is considered to represent background concentrations for ground water near the PWS sources. The GWIC database for the East Helena area is included in Appendix C.

East Helena currently has several sites where ground water contamination is present. The closure of the ASARCO plant in East Helena is associated with the discovery of a plume of arsenic present in ground water in the area beneath the town. The locations of the East Helena PWS sources away from the central part of town place them in a position away from this contamination. The data on ground water in the area proximal to the ASARCO plant is not present in the GWIC database, and therefore is not included in Table 1. However, the presence of elevated levels of arsenic has been determined north of the plant area, and elevated levels of other metals such as lead, zinc and copper have been detected in the water beneath the plant area. The second site is an Underground Storage Tank release, which has impacted ground water in central East Helena with petroleum hydrocarbons. This site has an ongoing ground water remediation system present at the time of preparation of this report. The nature of contamination and potential impacts of the ASARCO plant and the petroleum site to The Buzz Inn PWS are discussed in the inventory and susceptibility assessment portions of this document.

Table 1 – Background Water Quality in East Helena Area

Sample Information

Site Name	Twn	Rng	Sec	Q Sec	Type	Depth (ft)	Sample Date	Lab PH	Lab SC
PWS - 0.5 Mi S. of E. Helena	09N	03W	1	ABAB	Well		18-Nov-80	7.77	509.1
Maronic	10N	03W	23	DAAD	Well	180	9-Aug-90	6.98	945.7
L & C County Lagoons, E. Helena	10N	03W	24	DBD	Well	67.5	5-Sep-90	7.24	320.5
Jensen, David - North Well	10N	03W	25	CDBA	Well	82	13-Aug-90	6.96	1276.3
Jensen, David - South Well	10N	03W	25	CDBA	Well	160	8-Aug-90	6.93	587.6

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	Si mg/l	HCO3 mg/l	SO4 mg/l	Cl mg/l	NO3 mg/l	F mg/l	OPO4 mg/l	TDS mg/l
PWS - 0.5 Mi S. of E. H.	58.7	13.3	25.2	4.6	0.015	0.001	25.8	213	62	11.2	0.73	0.72		307.21
Maronic	39.27	8.68	14.44	4.79	0.302	0.242	48.1	115	66.6	4.5	0.56	0.3		244.62
L & C County Lagoons	31.3	7.91	18.8	2.58	0.013	0.01	23.9	112.7	59.7	4.7	0.84	0.29	<.1	205.61
Jensen, David - North Well	140	33.63	93.55	8.97	4.176	2.314	25.7	170	485	43.8	1.09	0.16		922.27
Jensen, David - South Well	76.27	16.58	20.96	5.14	<.004	<.002	51.3	142	161	17.8	0.28	0.3		419.58

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	Zn ug/l
PWS – 0.5 Mi S. of E. H.	<2.	<30.		70			<2.	<2.	22	11	<20.	<10.	<40.	320	6	<4.
Maronic	<4.	186		40	78	<100.	<5.	<5.	<4.	14	<40.	<20.		255	<4.	<6.
L & C County Lagoons	<4.	40		51	25	<100.	<5.	<5.	<4.	16	<40.	<20.	<50.	249	19	12
Jensen, David - North Well	<4.	133		251	40	3400	<5.	<5.	<4.	37	<40.	<20.		839	6	<6.
Jensen, David - South Well	<4.	<40.		<40.	92	400	<5.	<5.	<4.	18	<40.	<20.		509	<4.	<6.

3.0 HYDROGEOLOGIC SETTING AND DELINEATION

The source water protection area, the land area that contributes water to The Buzz Inn PWS, is identified in this chapter. For the PWS sources, 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 Prickly Pear Creek upgradient from the inventory zone.

The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the wells. The inventory region for the wells 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). The area east of East Helena is reviewed in a Wellhead Protection document for Eastgate Village prepared for DEQ by MBMG (1996). Additional hydrogeologic information was obtained for the area proximal to the ASARCO Plant from remedial investigation documents obtained from the United States Environmental Protection Agency. A geologic map of the Prickly Pear Creek Watershed Region showing the major units is depicted in Figure 4.

Ground water in the Helena Valley near East Helena is present as an unconfined alluvial aquifer. The Helena Valley is a structural basin with bedrock present along each boundary. 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; which is 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 East Helena area, the thickness of the alluvium increases northward away from town. Studies on the stratigraphy in the area surrounding the ASARCO plant in East Helena have evaluated the upper part of the water table aquifer separately from the lower part as “upper” and “intermediate” aquifers. A review of well logs from the area (Appendix B) does not show any distinct stratigraphic separation for the two aquifers. As a result, for purposes of this Source Water assessment, they are considered as a single aquifer since pumping from the lower part of the aquifer will induce vertical flow within the aquifer. The base of the alluvial aquifer is identified by the presence of an Oligocene volcanic tuff overlying the additional Tertiary beds. Water in the Tertiary beds is considered to represent a “lower” aquifer in the area. The Tertiary beds are exposed at the surface in the area east and southeast of East Helena. Additional pediment surfaces are present in areas south of East Helena, and they are considered part of the alluvial aquifer for this assessment.

Ground water in the East Helena area flows generally to the north, 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 Tertiary aquifer recharges the alluvium along the margins of the deposits of shallow alluvium. The alluvial aquifer recharges the Tertiary aquifer away from the margins. The depth to ground water in the East Helena area ranges from approximately 5 to 20 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 The Buzz Inn PWS, water is obtained from an unconfined alluvial aquifer. Generalized cross sections depicting the geology are shown in Figure 6. Ground water flow is generally to the north, following topography. Recharge to the aquifer occurs from stream loss from Prickly Pear Creek, infiltration from precipitation, and from the Tertiary sediments on the margins of the valley. The unconfined alluvial aquifer is considered to have a high source water sensitivity to contamination.

Well Information

The wells for The Buzz Inn PWS are located east of the East Helena city limits as depicted in Figure 3. Since there are no well logs with stratigraphy or well construction information, copies of well logs for other wells in the area are included in Appendix B. Well information is summarized in Table 2.

Table 2 - Source Well Information for The Buzz Inn.

Information	Laundry Well - Well 1	Northwest Well 2
PWS Source Code	002	003
Well Location	T10N, R2W, Sec 31 AAAC	T10N, R2W, Sec 31 AABB
	Lat 46.5865 N Long 111.8964 W	Lat 46.5872 N Long 111.8972 W
MBMG/GWIC #	--	--
Water Right #	--	--
Date Completed	--	--
Total Depth	--	--
Perforated Interval	--	--
Static Water Level	--	--
Pumping Water Level	--	--
Drawdown	--	--
Yield – Test Pumping Rate	--	--
Specific Capacity	--	--
Pumping Rate	--	--

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

Methods and Criteria

The methods and criteria used to delineate the source water protection zones for The Buzz Inn 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 each 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 wells 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 Prickly Pear Creek Watershed above The Buzz Inn (Figure 2). The alluvial aquifer is present in the base of the streams, and is recharged by ground water from the higher elevation areas. The ground water recharges the stream system, which loses water to the alluvial aquifer when it enters the Helena Valley. A surface water buffer zones is delineated around Prickly Pear Creek based on a standard distance criterion of ten miles upstream from the wells, with the buffer encompassing the land area of one-half mile width on each side of the major streams.

Model Input

The values selected for the calculation of time of travel represent conservative assumptions made to identify areas that may potentially impact The Buzz Inn PWS sources. The values for aquifer properties are based on delineation criteria developed for the wells in the City of East Helena PWS. The alluvial source aquifer is considered to have consistent aquifer properties between East Helena and the location of The Buzz Inn (Briar and Madison, 1992). The East Helena PWS wells are installed to the same aquifer the The Buzz Inn wells. Values for calculations for flow within the Tertiary Sediments, where exposed at the surface, are also listed with these model values. The criteria for selection of the values used for the delineation of the inventory zone are as follows:

Well Model Values:

- ***Thickness***: The value for the thickness of the aquifer (b) is estimated at 60 feet, based on the estimated thickness of the screened part of the aquifer, and the depth to ground water from well logs. The thickness of the Tertiary sediments is estimated at 100 feet, based on the well log.
- ***Hydraulic Conductivity***: A value for hydraulic conductivity (K) was estimated for the alluvial aquifer by EPA for a ground water model for the ASARCO site at approximately 850 ft/day. Briar and Madison (1992) estimated the hydraulic conductivity for the alluvium at 200 ft/day for the East Helena area. For this assessment, an estimated value of 550 ft/day is used for the alluvium, representing an average between the two presented values. For calculations for the Tertiary Sediments, a hydraulic conductivity value of 60 feet/day is used, based on information from Briar and Madison (1992)

- ***Transmissivity***: The transmissivity value for the alluvium is estimated at 33,000 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 change of 100 feet over a distance of 1.75 miles, for an estimated gradient of 0.0108. This study used a rounded value of 0.01. This gradient was used for both the alluvium and Tertiary aquifers
- ***Flow Direction***: The flow direction is considered due north, 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. The effective porosity for the Tertiary sediments is estimated at 10%, based on Briar and Madison (1992)
- ***Pumping Rate***: The pumping rate for the wells was estimated at 100 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 6,750 feet (1.28 miles) for a one-year time of travel (TOT), and a distance of 20,150 feet (3.82 miles) for a three-year TOT. The results of the calculations for the Tertiary sediment aquifer to the wells indicate an estimated distance of 2,675 feet (0.51 miles) for a one-year time of travel (TOT), and a distance of 7,225 feet (1.37 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 wells is depicted in Figure 7.

The inventory zone includes the eastern portion of the mapped area of alluvium within the Prickly Pear Creek floodplain immediately south of East Helena. The aquifer considers the Quaternary alluvium and an older Tertiary pediment surface, as mapped by Stickney (1987). The limits of these units are considered as aquifer boundaries, and the southern boundary to the inventory zone. The second part if the inventory zone is the area south of the alluvium where the Tertiary sediments are exposed at the surface, to the limit of the three-year time of travel distance for the Tertiary aquifer. A surface water buffer zone is delineated around Prickly Pear Creek upstream from where the stream crosses the inventory zone for the wells. The recharge region is considered to be the Prickly Pear Watershed area shown in Figure 2.

Limiting Factors

The lack on any data on the wells limits the evaluation of the source aquifer near the wells. The interaction of surface water between the alluvial aquifer and Prickly Pear Creek is not completely 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 The Buzz Inn 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 The Buzz Inn PWS focuses on all activities in the control zones, 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 sanitary sewers, septic systems and agriculture; petroleum hydrocarbons from underground storage tanks, 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 drains were observed as french-drains, which 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.
8. Animal feeding operations.

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).
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 Zones

The control zone represents the most critical point to protecting the integrity of a wellhead for ground water sources. The control zone for Well 1 is partially located within the Laundry building, which helps limit access to the wellhead. The land around the control zone for Well 2 is open, with no fencing or other protection from access. Septic systems from trailers represent the only potential contaminant source that may be present within the control zones.

Inventory Results/Inventory Regions

The inventory region represents the area near the source wells 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, with the locations shown on Figure 10. Completed inventory summary sheets for the significant potential contaminant sources are included in Appendix F.

The inventory region for the wells 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 agriculture, with the urban area around East Helena present, and the eastern part of the Helena city limits. The identified potential contaminant sources include the roads, railroad tracks, septic tanks, the Yellowstone Pipeline, and several automobile repair shops (Figure 10). The former ASARCO Smelter plant is located outside of the western boundary of the inventory zone. The only significant potential contaminant sources within a one-year time of travel distance to the well are a small mine prospect identified in DEQ files as a gold and silver mine for the Economy Mine Co.

The LUST sites and the ASARCO Smelter site represent areas where ground water contamination has been identified in the source aquifer for The Buzz Inn PWS wells. While outside of the inventory zone, both of these sites represent existing contamination in the same source aquifer as The Buzz Inn PWS wells. The LUST site, Schiller's Service on East Main, currently has a ground water remediation system present. A review of DEQ site files indicate that free-phase petroleum hydrocarbons are present on the water table surface. The remediation system was operating at the time of preparation of this report, indicating that remediation of the system is an ongoing process.

Table 3 - Summary of Inventory Results for The Buzz Inn 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*
Sanitary Sewer System	*Pathogens and Nitrates*	*Leakage from sewer lines*
Wastewater Treatment Ponds	*Pathogens and Nitrates*	*Leakage from treatment cells or discharge lines*
Septic Systems	*Pathogens and Nitrates*	*Non-point source pollution, loading o f ground water system with effluent*
Storm Water Discharge Points	*Various chemicals*	*Non-point source releases from urban land use concentrated into point source to ground water; storm sewer system discharges to Tobacco River*
EPA Envirofacts Sites (Step 2)		
ASARCO Smelter (Closed)	*Metals, Various Chemicals*	*Arsenic Plume from plant; additional metal contamination at facility; possible chemicals*
American Chemet	*Various Chemicals*	*Storage and processing of various chemicals at site*
EPA-PCSs Sites (Step 3)	*No sites identified*	
DEQ Database (Step 4)		
Active USTs – 5 Sites	*Petroleum Hydrocarbons*	*Spill or leak from USTs and piping*
LUST Site – 2 Active Sites	*Petroleum Hydrocarbons*	*Existing contamination in surface and ground water*
LUST Site – 7 Closed Sites	*Petroleum Hydrocarbons*	*Existing contamination, or residual contamination after site closure*
CECRA Sites	*No sites identified*	
Landfills – 2 Active Landfills	*Various Chemicals*	*Landfill provides direct conduit for contamination to shallow ground water system*
Business SIC Code Search Results* (Step 5)		
Automotive Repair (6)	*Various VOCs*	*Accidental spill of small quantity of chemicals/fuels*
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*
Yellowstone Pipeline	*Petroleum Hydrocarbons*	*Disaster – break in pipeline resulting in release of transported fuels*
Gravel Pits and other Mining Activities	*Various chemicals*	*Provides a conduit for direct discharge of chemicals or waste into shallow ground water*
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. The results of the business SIC code search reflect types of facilities, with the number of facilities indicated in parentheses. Individual sites identified as significant potential contaminant sources are evaluated in Chapter 5.

Figure 8 – Land Use Classification

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

Table 4. Significant potential contaminant sources for The Buzz Inn PWS.

Source	*Contaminants*	*Description*
Agricultural Land Use	*Pathogens and Nitrate; Pesticide/Herbicides (SOCs)*	*Primary concern in cultivated and grazing lands in Prickly Pear Creek watershed upstream from wells.*
Urban Land Use	*Various*	*The majority of the East Helena urban area is upgradient from the well.*
Sanitary Sewer Main	*Pathogens and Nitrate*	*The East Helena city limits are sewered, within the inventory zone for the wells. Concern from leaks and backfill around sewers providing a preferred conduit for other contaminants to migrate.*
Septic Systems	*Pathogens and Nitrate*	*Area south of wells with moderate and high 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*
Landfill	*Various Chemicals*	*Landfill located south of inventory zone in Surface Water Buffer Zone around Prickly Pear Creek*
Major Roads	*Various Chemicals*	*Transportation corridors through town, concern over an accident and spill of any transported chemicals*
Railroad Lines	*Various Chemicals*	*Transportation corridors through town, concern over an accident and spill of any transported chemicals*
Yellowstone Pipeline	*Petroleum Hydrocarbons*	*Crosses through southern part of inventory zone, south of East Helena*
Gravel Pits and other Mine Prospects	*Various Chemicals*	*Provides a conduit for chemicals directly into shallow ground water system*
Class V Injection Wells	*Various organic chemicals*	*Not inventoried at this time (EPA responsibility); may provide conduits for chemicals into subsurface*

A plume with elevated Arsenic concentrations is present from the location of the former ASARCO Smelter. The Arsenic plume includes concentrations several orders of magnitude greater than the Federal and Montana State drinking water standard for Arsenic, which has recently been set at 10 parts per billion. Arsenic levels of more than 7,000 parts per billion have been detected in monitoring wells in ground water within East Helena. At the time of preparation of this report, the nature and extent of the Arsenic plume was still under investigation. Due to the size and extent of contamination at the ASARCO facility, investigation and remediation of contamination will be an ongoing process for several years. This includes the Arsenic plume, which has the potential to continue to migrate northward through East Helena.

Inventory Results/Surface Water Buffer Zones

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 Prickly Pear Creek watershed as 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 areas with septic systems and agricultural development with related potential contaminants.

Inventory Results/Recharge Regions
The recharge region for the wells is the Prickly Pear Creek Watershed. The East Helena landfill is present within the watershed area, south of East Helena. The area within the watershed is predominantly national forest land, with a limited amount of agriculture. A limited amount of mining has occurred within the watershed.

Inventory Update
The certified operator for The Buzz Inn 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 10 – Inventory Results

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 The Buzz Inn 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 The Buzz Inn 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 The Buzz Inn PWS source (Table 5). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 7). The susceptibility of each well to each potential contaminant source is assessed separately.

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 The Buzz Inn 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 The Buzz Inn PWS are listed in Table 7. The primary threats identified within the one-year time of travel distance are agricultural land use, high density areas with septic systems, and the mine prospect. The proximity of these sources results in the classification of the potential susceptibility of the wells as very high to contamination from each of these sources. The location of the railroad tracks, Yellowstone petroleum pipeline, and roads within the area all represent potential threats with a high to 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
Control Zone						
Septic Systems (Potentially)	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	High	None	Very High	Monitor system performance; connect to sanitary system if/when possible
Inventory Zone						
Agricultural Land	Pesticides/ Herbicides/ Nitrates and Pathogens	Infiltration and Runoff	High	None	Very High	Promote the use and development of agricultural BMPs for the area
Sanitary Sewer Main (potential)	Pathogens and Nitrate	Infiltration and Runoff	High	None	Very High	Monitor integrity of sewer lines
Septic Systems	Pathogens and Nitrate	Infiltration and Runoff	High	None	Very High	Connect to Sanitary Sewer System; monitor septic system performance
Gravel Pit/Mine Prospect	Various Chemicals	Direct infiltration	Moderate	None	High	Restrict access to the gravel pit
Active USTs	Petroleum Hydrocarbons	Leakage, Infiltration and Runoff	High	Compliance with 1998 EPA upgrade regulations	High	Monitor operating compliance results
Major Roads	Various Chemicals	Spills	High	None	Very high	Develop emergency response plan
Railroad Lines	Various Chemicals	Spills	Moderate	None	High	Develop emergency response plan
Yellowstone Pipeline	Petroleum Hydrocarbons	Spills	Moderate	None	High	Develop emergency response plan
Recharge Area and Surface Water Buffer Zones for Prickly Pear Creek Watershed						
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

6.0 REFERENCES

Alden, W.C., 1953. Physiography and Glacial Geology of Western Montana and Adjacent Areas; U.S. Geological Survey Professional Paper 231.

Briar, D.W., and J.P. Madison, 1992. Hydrogeology of the Helena Valley-Fill Aquifer System, West-Central Montana; U.S. Geological Survey Water Resources Investigations Report 92-4023.

Fetter, C.W., 1994. Applied Hydrogeology, Macmillan College Publishing Co., New York, NY.

Heath, R., 1982. Basic Ground Water Hydrology, U.S. Geological Survey Water Supply Paper 2220.

Madison, J.P., 1993. Hydrologic Model of an Intermontane Basin, Helena Valley, Western Montana; University of Montana Masters Thesis.

Montana Bureau of Mines and Geology (MBMG), 1996. May Activity Report to Montana Department of Environmental Quality, Wellhead Protection Program, Task Order 430007-TO-27.

Montana Department of Environmental Quality (DEQ), 1999. Montana Source Water Protection Program.

Montana Department of Natural Resources and Conservation, 1986. Montana Water Use in 1980: Helena.

Moreland, J.A., and R.B. Leonard, 1980. Evaluation of shallow aquifers in the Helena Valley, Montana; U.S. Geological Survey Professional Paper 1316.

Ross, C.P., Andrews, D.A., and I.J. Witkind, 1955. Geologic Map of Montana; United States Geological Survey, in cooperation with the Montana Bureau of Mines and Geology.

Stickney, M.C., 1987. Quaternary Geology of the Helena Valley, Montana; Montana Bureau of Mines and Geology, Geologic Map Series 46.

Thamke, J.N., 2000. Hydrology of the Helena Area Bedrock, West-Central Montana 1993-1998; with a section on Geologic Setting and Generalized Bedrock Geologic Map by Mitchell Reynolds. U.S. Geological Survey Water Resources Investigations Report 00-4212.

Todd, D.K., 1980, Ground Water Hydrology, John Wiley and Sons, New York, NY.

United States Environmental Protection Agency (EPA), 1993. Seminar Publication – Wellhead Protection: A Guide for Small Communities, EPA/625/R-93/002.

United States Geological Survey, 2000. Preliminary land use classification data for Montana