Town of Plentywood
Public Water System

PWS ID # MT0000306

Source Water Delineation and Assessment Report

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Prepared by:
Source Water Protection Program
Montana Department of Environmental Quality

Prepared for:
James Stenehjem and Alvin Hollatz
Certified Operators

Plentywood Water Department
P.O. Box 1
Plentywood, MT 59254
phone: 406-765-1700

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EXECUTIVE SUMMARY

Plentywood's drinking water is currently supplied by two wells located approximately four miles southeast of town. This Source Water Delineation and Assessment Report was prepared under the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is conducting these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the Inventory Region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

Based on the sanitary surveys, well logs, and regional geology, glacially derived sand and gravel channel outwash material is providing water to the PWS's wells. In accordance with the Montana Source Water Protection Program criteria (1999), the aquifer (source water) is considered to have a high to moderate sensitivity to potential contaminant sources since it because the aquifer is semi-confined to unconfined and is an unconsolidated alluvial/glaciofluvial aquifer. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

Three types of source water protection management regions for the Town of Plentywood public water system were mapped as part of this assessment. They are the control zone, inventory region and the recharge region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- The goal of management in the control zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. The control zone is delineated as a 100-foot radius around the wells and all sources of potential contaminants should be excluded in this region. The only potential contaminant source identified within the control zone is agricultural cropland.
- The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region includes the area of land overlying the aquifer upgradient (northwest to west) of the well that is expected to supply groundwater recharge to the well over the next three years. Significant potential contaminant sources identified within the inventory region include: agricultural lands and the transportation corridors (Highway 16 and the railroad).
- The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage. The recharge region for the Town of Plentywood wells includes the alluvial all glaciofluvial valley fill sediments in the Big Muddy Creek valley upstream of the PWS wells. The topographic divide that represents the watershed boundary (based on the 5^{th} field USGS hydrologic unit) is used as the northern boundary of the recharge region. Significant potential contaminant sources identified within the recharge region include: agricultural crop lands, the transportation corridors, and multiple potential sources within the Town of Plentywood including the sanitary sewer mains, waste water treatment plant, treated wastewater discharge locations; underground fuel storage tanks; an RV dump site; a former spill response site; and several local businesses/facilities in the area that may be potential contaminant sources based on their potential to use or generate hazardous chemicals.

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is determined by

considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the public water supply well intakes. **The Plentywood public water supply has a high to very high susceptibility to the following potential contaminant sources: agricultural cropland and the highway transportation corridor.** Potential sources located outside the Inventory Region, but within the Recharge Region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for Town of Plentywood. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high. Developing and approach to protect that resource will reduce the risks of a contamination event occurring. In this report, we have summarized the local geology and well construction issued as they pertain to the quality of your drinking water source. We have identified the area we believe to be most critical to preserving your water quality (the Inventory Region) and have identified potential sources of contamination within that area. In addition, we provide you with recommendations, i.e., Best Management Practices, regarding the proper use and practices associated with some common potential contamination sources. We believe public awareness is a powerful tool for protecting drinking water. The information in this report will help you increase public awareness about the relationship between land use activities and drinking water quality.

INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was prepared for the Town of Plentywood Public Water Supply, PWS ID# MT0000306, located in Sheridan County. It was completed by Julie Harvey with the Source Water Protection Program at the Department of Environmental Quality with the assistance of Jim Stenehjem, Plentywood Water Department water system operator.

PURPOSE

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Town of Plentywood Public Water System (PWS) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (Public Law 104-182). The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is "delineation and assessment." Delineation is a process whereby areas that contribute water to aquifers or surface water bodies that are used to supply drinking water are identified on a map. These areas are called source water protection areas. Assessment involves identifying locations in the delineated areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information that helps Town of Plentywood protect its drinking water sources.

LIMITATIONS

This report was prepared to assess threats to the Town of Plentywood 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 the source of the Town of Plentywood public water supply and not to any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area of the Town of Plentywood public water supply are identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered.

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

CHAPTER 1
BACKGROUND

THE COMMUNITY

Plentywood is located in central portion of Sheridan County approximately 20 miles south of the US/Canadian boarder and 25 miles west of the Montana/North Dakota Border (Figure 1). The U.S. Census Bureau estimates the 2000 population of Sheridan County at 4,105 people with 2,061 of these people residing in Plentywood (http://factfinder.census.gov). The Town of Plentywood is served by a municipal sewer system with two aerobic lagoons for its sewage treatment. Properties outside the town limits are served by individual or large-capacity on-site septic systems.

Plentywood's drinking water is supplied by two wells located between the railroad tracks and the highway approximately four miles southeast of town (Figure 1). Plentywood's public water system (PWS) is classified as a community PWS and serves a total population of 1,700 people through 906 connections. A regional water system (the Fort Peck Assiniboine and Sioux/Dry Prairie Rural Water Supply system) is being developed for the area; however, the Town of Plentywood will not be connected to this system in the near future (city personnel estimate that it will be at least 10 years).

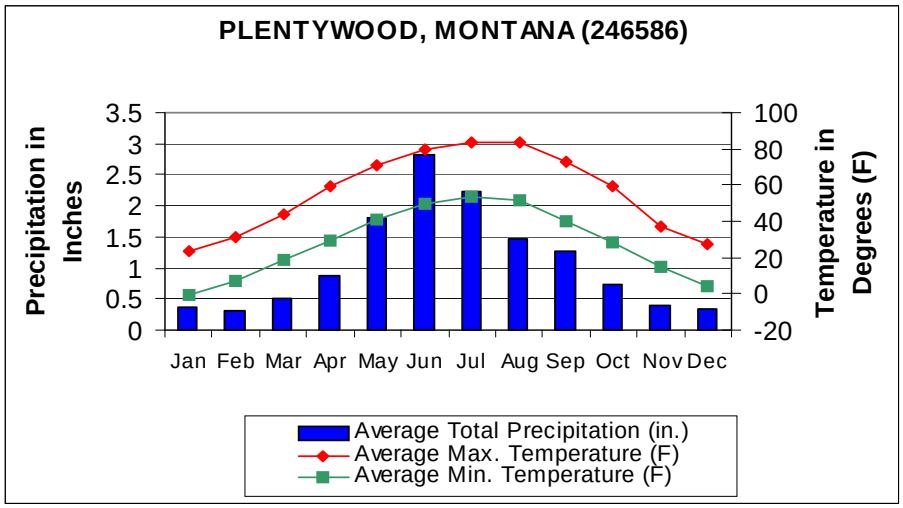
Agriculture plays a major role in Plentywood's economy. The Plentywood area produces 7% of the nation's total durum wheat on 200,000 acres of cropland. Spring wheat is produced on 100,000 acres. Many specialty crops are produced on dry land and irrigated land, including canola, mustard, flax, peas, lentils, chick peas, alfalfa, sugar beets, and pinto beans. Livestock production includes beef cattle along with some hogs and sheep (http://www.gndc.org/plenty.htm).

GEOGRAPHIC SETTING

Plentywood is located in the northeastern corner of Montana in the Glaciated Central Region (Heath, 1984), which is a geographic area in northern Montana that extends east roughly from the Rocky Mountain Front to the North Dakota Border. Continental glaciers extended into this region during several episodes of glaciation. The town elevation is approximately 2,050 feet and the surrounding upland areas are about 2,250 feet. Plentywood is situated in the valley of Big Muddy Creek, which is a tributary to Missouri River. Plentywood is located in the Big Muddy Creek watershed, U.S. Geological Survey (USGS) hydrologic unit code (HUC) Number 10060006, which is located within the Lower Missouri River Watershed Management Region for Montana. The Big Muddy Creek hydrologic unit covers about 253 square miles in Sheridan, Daniel and Roosevelt Counties. It includes Big Muddy Creek and its tributaries from the US/Canada Border to Big Muddy Creek's confluence with the Missouri near Culbertson.

CLIMATE

Information on climate in the Plentywood area is based on the National Oceanic and Atmospheric Administration's (NOAA) Plentywood climate station located at an elevation of 2,040 feet above mean sea level (Western Regional Climate Station). Average temperatures and total precipitation for the period of 1948 to 2003 are shown in the graph. Average annual precipitation is 13 inches. Monthly average precipitation ranges from 0.30 inches in February to 2.26 inches in July. The annual mean snowfall in Plentywood is 21 inches with an average of 1 to 5-inches of measurable snow accumulation during the winter months.



GENERAL DESCRIPTION OF THE SOURCE WATER

Plentywood's drinking water is currently supplied by two wells located approximately four miles southeast of town (Figure 1). The wells are Well #10A (DEQ Source Number WL013) and Well #11. Well # 11 was completed in September 2002 to replace Well #10 (which is located in the nearby well house) when the casing for Well #10 "caved in" (personal correspondence with PWS operator, 3/17/04). A DEQ Source Number for Well #11 was not readily available. Plentywood also had ten other wells (Wells 1 through 9 including 5A) that are inactive and were abandoned in 2002 (Correspondence in the DEQ PWS file dated 7/31/2002) because of water quantity problems (personal correspondence with the PWS Operator, 4/6/2004).

The two wells are completed at relatively shallow depths (screened intervals of about 45 to 70 feet deep) with static water levels of approximately 3 and 10 feet below ground surface at the time of drilling. The water source material is interpreted to be sand and gravel channel outwash material that was deposited by glacial meltwater. As the continental glaciers advanced, the outwash channels were buried with till consisting of silt, sand and clay. The aquifer is semi-confined to unconfined. The overall groundwater flow direction in the vicinity of the wells is towards the southeast parallel to Big Muddy Creek; however, there is likely significant seasonal variation in the east/west component of groundwater flow. Recharge to the wells is likely from infiltration of precipitation and local surface water through the overlying glacial and alluvial materials in the Big Muddy Valley. Additional detail on the geology and hydrogeology of the area is provided in Chapter 2.

THE PUBLIC WATER SUPPLY

The town of Plentywood is classified as a community public water system (PWS) and serves 1,700 people through 906 connections. The PWS is classified as a community water system since it serves at least 25 of the same people every day. Information on the water system was obtained from correspondence in the DEQ Public Water Supply Section files including the most recent sanitary survey completed on May 27, 2003 (included in Appendix A) and personal communication with the PWS operator.

There are two active wells that Plentywood uses as its supply, Well #10A and Well #11. The well field produces 650,000 to 750,000 gallons per day. The treatment plant at Plentywood has two pressure sand filters that reduce the iron and manganese content of the raw water from the wells and the drinking water is disinfected with chlorine gas. The distribution system includes a million-gallon storage tank located northeast of town. A map of the distribution system is provided in Appendix A. The 2003 Sanitary Survey indicates that water system is well maintained and efficiently operated and no deficiencies were noted.

In 1999, DEQ completed an assessment of the source water for the Ground Water Under the Direct Influence of Surface Water (GWUDISW) program. The assessment indicated that the source water is not under the direct influence of surface water and the source was classified as "groundwater".

WATER QUALITY

PWS Water Quality Monitoring Results

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring constituents include coliform and other signs of pathogenic organisms, nitrates, metals and multiple organic chemicals. The monitoring schedule depends on many factors such as the size and source water for a PWS, the number of sources (e.g. wells), and the population served. Each PWS has a specific monitoring program tailored to their system that follows the general protocols for operation of a PWS defined by DEQ. The Plentywood PWS monitoring data from DEQ's PWS database for the past five years was reviewed and is summarized in this section.

The only compounds detected in Town of Plentywood's source water monitoring over the past 5 years include low levels of radium 226 (0.3 pCi/L), nickel (0.02 mg/L), bromodichloromethane (0.00090 mg/L), and chloroform (0.0015 mg/L). The latter two compounds are likely associated with the distribution system and are probably not in the source water. These detections are all below EPA primary maximum contaminant levels (MCLs) where established. Total coliform and nitrate has not been detected in the source water.

Background Water Quality Monitoring Results

Groundwater sampling data collected to characterize background groundwater quality was not identified for Plentywood's Well #10 or Well #11. Water quality sampling results for other wells in the area including several of Plentywood's old wells (that are now abandoned), private wells and a Montana Bureau of Mines and Geology (MBMG) test well. Background water quality sampling typically includes some general water quality parameters including major cations and anions (calcium, magnesium, sodium, potassium, iron, manganese, silica, bicarbonate, carbonate, chloride, sulfate, nitrate, fluoride and orthophosphate) and trace elements and metals. Copies of the well logs, the water quality results from the GWIC database, and a comparison of the results to maximum contaminant levels for four of the wells located closest to Plentywood's current well field is provided in Appendix B.

None of the analytical results exceeded the primary MCLs where primary MCLs are established. National secondary drinking water standards (SMCLs) are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as taste, odor, or color) and are generally not a health risk. SMCLs for sulfate, iron and manganese were exceeded in at least one of the four wells in proximity to the Plentywood well field. Plentywood Water Department's treatment system removes most of the iron and manganese from the source water before distribution. No other SMCLs were exceeded. Although the sodium concentrations detected in regional water (100 to 149 mg/L) do not exceed the SMCL of 250 mg/L, water systems having greater than 20 mg/L of sodium in their drinking water source are encouraged to inform their customers of the presence of this constituent so that those individuals on a physician-prescribed low-sodium diet can inform their doctors of this source of sodium in their diet.

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to the Town of Plentywood PWS is identified in this chapter. Three management areas are identified within the source water protection area. These three regions, the control zone, inventory region, and recharge region, are delineated for the wells. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around each well. The inventory region represents the zone of contribution of the well, which typically approximates a three-year groundwater time-of-travel. Analytical equations describing groundwater flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The recharge region represents the area where the source aquifer for the Town of Plentywood water system wells is replenished.

GENERAL GEOLOGIC AND HYDROGEOLOGIC SETTING

This section provides an overview of the geology and hydrology of the Plentywood area and is primarily based on a publication by Donovan (1998) with additional data provided in publications by Vorhis (1949), Witkind (1959), and Levings (1985). In addition, well logs for the Plentywood PWS wells and regional well logs available from the Montana Bureau of Mines and Geology (MBMG) Ground-Water Information Center (GWIC) were used. A regional geologic map is provided in Figure 2. The geology of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers. An understanding of hydrogeologic conditions also provides an explanation for the sensitivity of local aquifers to potential contaminant sources.

The stratigraphy in northeast Montana generally consists of alluvium, terrace and glacial deposits which overly the bedrock of the Fort Union Formation. The alluvium consists of fine- to coarse-grained floodplain deposits including clay, silt, and sand with occasional gravel lenses. The alluvium is primarily present at the surface near Big Muddy Creek and its major tributaries. Remnant terrace deposits consisting of locally derived silt, sand and gravel are present on the hillsides and in the valleys. Throughout the area north of the Missouri River lies an extensive gradually sloping series of dissected upland plateaus occupy the upland areas. These plateaus form the Flaxville Plain and the gravels are highly permeable.

Continental glaciers extended into northeastern Montana during several episodes of glaciation leaving deposits of till and outwash materials mantling the bedrock. In some places, glacial debris buried older stream valleys and the alluvium within the valleys. The till is generally a poor aquifer because of its low permeability (the ability to transmit water); however, the sand and gravel in buried outwash channels and lenses between till units transmits water and are important aquifers. Based on Donovan (1988), “outwash is found in the modern drainage channels of both major and minor streams” including Big Muddy Creek. “In addition, it (outwash) is found in old glacial meltwater channels, both with channel morphology exposed at the surface and with morphology buried by younger glacial deposits. …Outwash gravel aquifers yield from 20-100 gpm (gallons per minute) in small diameter wells and in excess of 500 gpm in large diameter irrigation or municipal wells. Because they commonly occur in low-lying depressions and consist of sand and gravel from the surface down, they (the outwash deposits) are efficient in collecting recharge from precipitation and so have generally good water quality characteristics for drinking and irrigation use.”

The alluvial and outwash channel aquifers form shallow flow systems perched on bedrock beneath the Missouri, Poplar, Big Muddy and numerous tributary valleys. Where the aquifer materials are near the streams and exposed at the surface, the groundwater flow direction is controlled primarily by stream stage. In rising or high-water periods, stream water infiltrates outward to be held as bank storage. As stream stage recedes, this bank storage is released to the stream. Pumping from wells placed close to the stream in the pervious alluvium induce stream infiltration. In areas where the alluvium and glacial outwash channels are buried by till (such as in Plentywood's PWS wells), the groundwater flow is controlled more by boundary conditions and recharge locations (Donovan, 1988).

The glacial deposits are underlain by the poorly cemented sandstone, shales, clays, and lignites (coal) of the Fort Union Formation (Vorhis, 1949) of Tertiary age. The bedrock in this part of Northeast Montana lies on the western flank of the Willinston Basin which a large-scale structure centered near Williston, North Dakota (Donovan, 1988). The Fort Union Formation underwent structural deformation during the formation of the Williston Basin which resulted in a southeast dip direction of the Fort Union Formation in the vicinity of Plentywood. In general, the mudstone and shale layers do not yield water to wells but some of the sandstone and coal beds yield small quantities (usually less than 15 gallons per minute) of water to stock or domestic wells. Groundwater in the Fort Union formation generally flows from west to east following the structural trend of the Willinston basin.

PWS WELL INFORMATION

Plentywood's drinking water is currently supplied by two wells located approximately four miles southeast of town (Figure 1). Copies of the available well logs and test well logs showing stratigraphic and well construction information are included in Appendix C and the well information is summarized in Table 1.

Well # 10A (Test Hole "15") was drilled in 1994 and Well # 11 was drilled in 2002. Both wells were drilled to 102 feet below surface and encountered approximately 23 to 26 feet of low permeability clay (or sandy clay) underlain by layers of sand and gravel with coal inclusions. Well #10A (DEQ Source Number WL013) was screened from 51 to 66 feet bgs in a gravel and coal layer. Well #11 was screened from 55 to 70 feet in sand and gravel. The static water levels recorded at the time of drilling were approximately 3 and 10 feet below ground surface (for well 10A and 11 respectively).

The water source material is interpreted to be sand and gravel channel outwash material that was deposited by glacial meltwater. As the continental glaciers advanced, the outwash channels were buried with till consisting of silt, sand and clay. The high static water levels indicate that the aquifer is locally semi-confined, however, for the purpose of this assessment, the aquifer is considered unconfined since the overlying clayey materials are not likely laterally continuous due to the nature of glacial deposition. The overall groundwater flow direction in the vicinity of the wells is towards the southeast parallel to Big Muddy Creek; however, there is likely significant seasonal variation in the east/west component of groundwater flow. Recharge to the wells is likely from infiltration of precipitation and local surface water through the overlying glacial and alluvial materials in the Big Muddy Valley.

CONCEPTUAL MODEL AND ASSUMPTIONS

The Town of Plentywood's two active production wells are located in the Big Muddy Creek watershed (USGS Hydrologic Unit Code 10060006) which is located within the Lower Missouri River Watershed Management Region for Montana. The source of Town of Plentywood's drinking water is interpreted to be sand and gravel channel outwash material that was deposited by glacial meltwater. As the continental glaciers advanced, the outwash channels were buried with till consisting of silt, sand and clay. The aquifer is semi-confined to unconfined. The overall groundwater flow direction in the vicinity of the wells is towards the southeast parallel to Big Muddy Creek; however, there is likely significant seasonal variation in the east/west component

of groundwater flow. Recharge to the wells is likely from infiltration of precipitation and local surface water through the overlying glacial and alluvial materials in the Big Muddy Valley.

Table 1. Summary of Well Log Information for PWS Production Wells

	Former Well #10 (Replaced by Well #11 in 2002)	**Well #10A**	**Well #11**
PWS Source Code	WL012	WL013	Not Assigned
Well Location	SE¼, NW¼, SW¼, Sec.35, T35N, R55E	SE¼, NW¼, SW¼, Sec.35, T35N, R55E	SW¼, SW¼, SW¼, Sec.35, T35N, R55E
Well Elevation	Approx. 2,000 feet	Approx. 2,000 feet	Approx. 2,000 feet
Date Completed	6/25/1986	12/20/1994	8/14/2002
Total Depth (bgs)	65 feet (there was an adjacent test hole completed to 83 feet)	66 feet (there was an adjacent test hole completed to 102 feet)	70 feet (there was an adjacent test hole completed to 102 feet)
Well Completion: Casing	12-inch (steel?)	10-inch steel(?) from 3 feet above surface to 51 feet bgs	12-inch stainless steel from 3 feet above surface to 55 feet bgs
Well Completion: Screen	20 feet of 60-slot SS screen. Depth of screen is not recorded but assumed to be 45 to 65 feet bgs in "gravel" based on test hole geology and total well depth.	10-inch stainless slotted screen from 51 to 66 feet bgs in "gravel and coal"	12-inch stainless slotted screen (60-slot) from 55 to 70 feet bgs in "sand and gravel"
Well Completion: Annular Seal	Unknown	Cement and bentonite grout to 35 feet bgs	Bentonite grout to 40 feet bgs
Static Water Level (at time of drilling)	2.9 feet bgs	14 feet bgs	10 feet bgs
Well Pump Test Data	23.6 feet of drawdown after 24 hours of pumping at 1,500 gpm. Driller notes specific yield of 63.55 gpm per foot drawdown however "well was not stabilized completely and specific yield will drop some under continuous pumping".	35.43 feet of drawdown after 11 hours of pumping at 770 gpm	39.35 feet of drawdown after 10.6 hours of pumping at 910 gpm (See Appendix C for pump test data)

Notes: bgs – below ground surface; gpm – gallons per minute

Using DEQ Source Water Protection Program criteria for ranking aquifer sensitivity (Table 2), the Town of Plentywood source water is considered as having **High to Moderate Source Water Sensitivity** to contamination because the aquifer is semi-confined to unconfined and is an unconsolidated alluvial/glaciofluvial aquifer. Sensitivity is defined as the relative ease that contaminants can migrate to source water.

Table 2. Source Water (Aquifer) Sensitivity Criteria
based on DEQ Source Water Protection Program Criteria (DEQ, 1999)

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

DELINEATION

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). Source water protection areas delineated for the Plentywood PWS include controls zones for each well, an inventory region, and a recharge region. The delineated management zones for the wells are shown on Figure 3.

Control Zones - 100-foot radius control zones are delineated for Town of Plentywood's wells. All sources of potential contaminants should be excluded in this region.

Inventory Region - For the Plentywood wells, the DEQ's Source Water Protection Program criteria for an unconfined aquifer system was followed. The inventory zone was delineated based on a ground water time-of-travel (TOT) distance of one and 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 and the information on the well logs. The results of the calculations indicate an estimated distance of approximately 2,100 feet (0.40 miles) for a one-year TOT and a distance of 4,500 feet (0.85 miles) for a three-year TOT. A summary of the time of travel calculations is included in Appendix D. The inventory zones for the wells were broadened to reflect potential changes in the groundwater flow system during seasonal periods of high and/or low flow. All sources of potential contaminants are inventoried in this region.

Recharge Region – The recharge region for the Town of Plentywood wells includes the alluvial all glaciofluvial valley fill sediments in the Big Muddy Creek valley upstream of the PWS wells. Upland areas bound the recharge area on the east and west. For the purpose of this assessment, the northern (upgradient) boundary of the recharge region was established at the USGS fifth-field hydrologic unit watershed boundary (shown on Figure 3). The inventory for the recharge region focuses on general land uses and large industrial facilities. The goal of management in the recharge region is to maintain and improve the long-term quality of groundwater in the aquifer.

LIMITING FACTORS

Delineation of the source water protection areas for the Town of Plentywood PWS wells is based on published reports and lithology indicated on the well logs. The interaction of surface water with the shallow buried channel deposits is not completely understood and the changes in the flow regime under seasonal conditions 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.

CHAPTER 3
INVENTORY

INVENTORY METHOD

An inventory of significant potential contaminant sources was conducted to assess the susceptibility of Town of Plentywood's wells to contamination and to provide a foundation for source water protection planning. The inventory for Town of Plentywood focuses on facilities that generate, use, or store potential contaminants and certain land uses in the inventory region delineated in the previous section. Sources of all primary drinking water contaminants and pathogens are identified, although only potential sources of contaminants that are the greatest threat to human health were selected for detailed inventory.

It is important to remember that the sites and areas identified in this section are only potential sources of contamination to the drinking water. Contamination of the drinking water is not likely to occur when potential contaminants are properly used and managed. Not all of these inventoried activities pose actual high risks to your public water supply. The day-to-day operating practices and contamination awareness varies considerably from one facility or land use activity to another.

The inventory for the Town of Plentywood PWS focuses on all activities in the control zones for the wells; certain types of municipal and private facilities or land uses in the inventory region; potential sources of nitrates and pathogens in the surface water buffer; and general land uses and large facilities in the Recharge Region. Databases were searched to identify businesses and land uses that are potential sources of regulated contaminants. The process for completing the inventory included several steps, which are summarized as follows:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html). Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.

Step 2: EPA's Envirofacts System (http://www.epa.gov/enviro/) was queried to identify EPA regulated facilities located in the inventory region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and the Permit Compliance System (PCS - for Concentrated Animal Feeding Operations with MPDES permits). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: Databases were queried to identify the following in the inventory region:

- Underground Storage Tanks (UST) (http://www.deq.state.mt.us/UST/USTDownloads.asp)
- Hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau),
- Landfills (http://nris.state.mt.us/gis/datalist.html), and
- Abandoned and active mines including gravel pits (http://nris.state.mt.us/gis/datalist.html)

Any information on past releases and present compliance status was noted.

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

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

Step 6: Public water system officials, or someone they designated as knowledgeable of the area, were interviewed to identify potential sources that are not listed in databases or on maps elsewhere (such as animal feeding operations that are not required to obtain a permit) and to assist in locating potential sources listed in the state and federal databases.

Step 7. Significant potential contaminant sources were identified in the control zone and inventory region and land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region

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

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

CONTROL ZONE INVENTORY RESULTS

The 100-foot control zone for the wells includes the well house, which is located about 50 feet from the wells and the adjacent cropland. The well casings extend at least 12 to 18-inches above the ground and are properly sealed. Neither of the wells is enclosed. The Town of Plentywood has easements for the control zone around the wells. The only potential source of contamination identified within the control zones is the agricultural crop lands.

INVENTORY REGION RESULTS

The inventory results for Town of Plentywood's source water are summarized in Table 3 and are shown on Figure 4 and Figure 5. Land cover in the inventory region for the Town of Plentywood PWS is reported in the 1992 National Land Cover dataset (Figure 4) to be primarily agricultural land (73%) and grasslands (24%) with the remaining 3% being the transportation corridors, forest, and open water. Cropped agricultural land use in more than 50% of the inventory region poses a high potential hazard to the water supply based on the Montana source Water Protection Guidance manual (1999) For cropped areas, over-application or improper handling of pesticides or fertilizers on agricultural lands could result in these compounds entering groundwater and impacting the drinking water supply. Excessive irrigation may cause increased transport of contaminants to groundwater. In pasture areas, animal wastes from concentrated livestock may impact the drinking water supply. Grasslands are not considered potential sources of contamination unless there are significant grazing operations in the area.

The Burlington Northern/Santa Fe Railroad and State Highway 16 pass through the inventory region (Figure 5). There is a potential for spills along the transportation routes and for spraying of pesticides and herbicides. The hazard posed by the highway is considered as high. Since the railroad is less frequently used, the hazard is considered moderate.

One oil/gas test well was identified within the inventory region. The well is listed as a "development well" with "no production" and likely poses a low hazard to the drinking water supply.

Septic system density within the surface water buffer region is low and is not considered a risk to the PWS drinking water. Several local businesses/facilities with a "Plentywood" address were identified in the regulatory databases used and in the business directory by SIC code. None of these businesses are located within the inventory region.

Table 3. Summary of Potential Contaminant Sources in the Inventory Region

Source Type	*Potential Contaminants*	*Description/Concern*
Land Use Cover (Step 1)		
Agricultural Crop Land (73%)	Nitrate and SOCs from fertilizer, pesticides and herbicides. Pathogens (if grazing occurs)	Over-application or improper handling of pesticides or fertilizers on agricultural lands could result in these compounds entering groundwater and impacting the drinking water supply. Excessive irrigation may cause increased transport of contaminants to groundwater. Improper storage and management of animal wastes may impact drinking water supply.
EPA Envirofacts Sites (Step 2)		
None identified		
DEQ Databases (Step 3)		
None identified		
Business – SIC Code Sites (Step 4)		
None identified		
Miscellaneous Others, including Step 5 and 6		
Burlington Northern/Santa Fe Railroad and State Highway 16	Various chemicals	Vehicle usage and rail transport increases the risks for leaks or spills of fuels and other hazardous materials that may impact drinking water. Over-application or improper handling of pesticides or fertilizers in the transportation corridor may impact the drinking water supply.
Oil and Gas test well	Total dissolved solids, petroleum products.	Improperly sealed or abandoned wells may facilitate contaminant transport to shallow or deeper aquifers.

Notes: Individual sites identified are evaluated in Chapter 4.

RECHARGE REGION INVENTORY RESULTS

Land use in the watershed/ recharge region is 46% percent agricultural crops/pasture land, 39% grasslands, and 10% residential/commercial/transportation with the remaining 5% being open water/wetlands and mixed forest (Figure 4). Cropped agricultural land present at 20 to 50 percent of the region poses a moderate risk to the water supply.

Transportation corridors (Highway 16, Highway 5, and the railroad) located within the recharge region pose a high potential hazard to the water supply due to the potential for spills along the transportation routes and for spraying of pesticides and herbicides.

The Town of Plentywood is located within the recharge region. Potential contaminant sources identified within Plentywood include the sanitary sewer mains, waste water treatment plant, treated wastewater discharge locations; underground fuel storage tanks; an RV dump site; a

former spill response site; and several local businesses/facilities in the area that may be potential contaminant sources based on their potential to use or generate hazardous chemicals. A list of these facilities with a Plentywood address are summarized in Appendix E. Potential point sources of contamination within the recharge region are generally assigned a low hazard.

Big Muddy Creek is on the Montana 2002 303d list of impaired streams. Currently, this creek is fully supporting for recreational contact but only partially supporting aquatic life and the warm water fishery beneficial uses. The probable causes for these rankings include copper, lead mercury, zinc, metals, nutrients, organic enrichment/low dissolved oxygen, other habitat alterations, and riparian degradation. The probable sources causing these types of impairments include agriculture, crop related sources and grazing related sources. Big Muddy Creek itself is not a significant potential source of contamination to groundwater within the recharge region; however, the surface water impairment is an indicator that the density of agricultural land has the potential to also affect groundwater.

Septic system density within the watershed/recharge region is low with the exception of two small areas adjacent to the Town of Plentywood. The areas with moderate to high septic system density are located far from the PWS wells and are not considered a risk to the PWS drinking water.

INVENTORY UPDATE

To make this SWDAR a useful document for the years to come, the certified water system operator should update the inventory for his records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ every five years to ensure the source water delineation and assessment remains current.

INVENTORY LIMITATIONS

The potential contaminant sources described above are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The use of multiple sources of information, however, should ensure that the major threats to the source water for Plentywood's public water supply have been identified. The lack of identification of a potential contaminant source in the inventory or susceptibility assessment of this report does not mean that the potential for contamination does not exist or there is not a threat. It is highly recommended that the PWS and community "enhance" or refine the identification of the potential contamination sources through further research and local input.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

GENERAL DISCUSSION

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose a concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Town of Plentywood PWS managers and operators. The goal of Source Water Management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the inventory region, and 3) ensuring that major land use activities or other significant activities in the recharge region pose minimal threat to the source water. Management priorities in the inventory region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the PWS managers and operators to reduce susceptibility are recommended in this chapter.

HAZARD DETERMINATION

The proximity of a potential contaminant source to a spring or well intake, potential contaminant migration pathways, or the density of potential non-point contaminant sources determines the threat of contamination, referred to here as hazard (Table 4). Hazard and the existence of barriers to contamination determine susceptibility, which is described in Table 5. Table 4 below describes the criteria to determine hazard within the inventory region as it was delineated in this SWDAR. Note that this table is specific to PWSs that draw their water from unconfined aquifers. The determination of hazard is somewhat different for other types of water sources.

Table 4. Hazard of Potential Contaminant Sources for Wells Drawing Water from Unconfined Aquifers

Type of Potential Contaminant Source	High Hazard	Moderate Hazard	Low Hazard
Septic System Density (# per square mile)	More than 300 septic systems per sq. mile	Between 50 and 300 septic systems per sq. mile	Less than 50 septic systems per sq. mile
Municipal or Community Sanitary Sewer (% land use)	More than 50 percent of the inventory region	Between 20 and 50 percent of the inventory region	Less than 20 percent of the inventory region
Cropland (% land use)	More than 50 percent of the inventory region	Between 20 and 50 percent of the inventory region	Less than 20 percent of the inventory region
Point sources of all contaminants	Within 1-year TOT	1-3 years TOT	Over 3-year TOT

Note: Highlighted areas are those relevant to the Town of Plentywood inventory region

DISCUSSION OF SUSCEPTIBILITY

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 Town of Plentywood PWS well intakes (Table 5).

Table 5. Susceptibility Based on Hazard and Barriers

Presence Of Barriers	Hazard		
	High	**Moderate**	**Low**
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Barriers to contamination can be anything that decreases the likelihood that contaminants will reach a spring or well. Barriers can be engineered structures, management actions, or natural conditions. Examples of engineered barriers are spill catchment structures for industrial facilities and leak detection for underground storage tanks. Emergency planning and best management practices are considered management barriers. Thick clay-rich soils, a deep water table or a thick unsaturated zone above the well intake can be natural barriers.

The density and low permeability of the 23 to 26-foot layer of glacial clay (till) that was identified in the well logs serves as a natural barrier to potential contaminant sources in the near vicinity of the wells. However, the lateral extent of the clay layer is not known. The lateral extent of glacial materials deposited by alternating advancing and receding glacial events can be very variable. Therefore, the clay can be considered a barrier to potential contaminant sources within the control zone but is likely not a barrier in the rest of the inventory region. No other natural barriers were identified for Plentywood's PWS wells.

A summary of the susceptibility assessment for Town of Plentywood PWS production wells is located in Table 6. Because a contaminant source has not been identified in the inventory or susceptibility assessment of this report, it doesn't mean that the potential for contamination does not exist or is not a threat. Table 6 only includes the potential contaminant sources identified in Chapter 3 that were determined to present a significant potential risk to the drinking water supply. Low risk potential sources such as the oil and gas test hole location was not included. It is highly recommended that the PWS operator and community members familiar with the nature of businesses and land use in the area enhance the inventory through further research and local input.

Table 6. Susceptibility Assessment of Significant Potential Contaminant Sources

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Inventory Region						
Agricultural Crop Land (73%)	Nitrate and SOCs from fertilizer, pesticides and herbicides. Pathogens (if grazing occurs)	Contaminants leaching into groundwater	***High***	- Clay till layers overly the aquifer near the wells – no barriers identified for rest of inventory region.	***Very High Susceptibility***	Encourage use of agricultural best management practices (BMPs) in the inventory and recharge region
Transportation Corridor – (Highway 16 and the Burlington Northern Santa Fe Railroad)	Pesticides, fertilizers, VOCs, SOCs, others	Spills, routine spraying, storm water runoff, infiltration into groundwater	***High*** *(Moderate for the Railroad)*	- County Emergency Response Plan, training and preparation of local response personnel	***High Susceptibility (Moderate for the Railroad)***	Emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground, cooperation with railroad managers or MDOT to reduce herbicide use.
Recharge Region						
Agricultural Crop Land (46%)	Nitrate and SOCs.	Contaminants leaching into groundwater	***Moderate***	- None	***Not Rated –*** *outside the inventory region*	Encourage use of best management practices (BMPs)
Transportation Corridors (Highway 16, Highway 5 and Burlington Northern Santa Fe Railroad)	Pesticides, fertilizers, VOCs, SOCs, others	Spills, routine spraying, storm water runoff, infiltration into groundwater	***High***	- County Emergency Response Plan, training and preparation of local response personnel	***Not Rated –*** *outside the inventory region*	Emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground, cooperation with railroad managers or MDOT to reduce herbicide use.
Town of Plentywood Waste Water System - sanitary sewer mains - waste water treatment plant - treated wastewater discharge locations/lagoons - RV dump site	VOCs, SOCs, metals, pathogens, nitrates, others	Ongoing or catastrophic leakage of sewage into groundwater	***Low***	- Distance from the PWS well(s)	***Not Rated –*** *outside the inventory region*	Maintenance, rehabilitation, or replacement of existing sewer mains, use of sewer main liners, rapid response planning for leaks or ruptures.
Town of Plentywood - UST/LUST/spill response sites - businesses/facilities that may use or generate hazardous chemicals based on SIC code. See Appendix E.	VOCs, SOCs petroleum hydrocarbons and other chemicals	Contaminants leaching into groundwater	***Low***	- Most handle only small volumes of potential contaminants and are far from the PWS well(s) - On-going remediation/ monitoring and compliance with 1998 UST upgrades	***Not Rated –*** *outside the inventory region*	Pollution prevention education; training in waste reduction, handling and recycling; regulatory oversight; promotion of good housekeeping. Review permit status for USTs and ensure proper operation and maintenance. Verify existing contamination is being properly removed or remediated. Properly abandon and remove USTs if out-of-service.

Notes: VOCs - Volatile organic compounds (i.e. solvents, fuel components) SOCs - Synthetic Organic Compounds (i.e. pesticides, herbicides, plasticizers)
UST - underground storage tank LUST - leaking underground storage tank

The susceptibility assessment results for each significant potential contaminant source identified within the Inventory Region are described below. Sources located outside the Inventory Region, but within the Watershed/Recharge Region may still pose a threat over time, but are not discussed in detail.

Agricultural Cropland – The potential hazard imposed by nitrates, herbicides and pathogens originating from agricultural lands is high based on the percent of the total land use in the inventory region. The clay tills serve as a barrier to downward migration in the near vicinity of the wells; however, the lateral extent of the till is not known so the overall susceptibility is ranked as very high.

Transportation Corridors–Highway 16 and the railroad corridor pass through the inventory region and the railroad comes close to the wells. The potential for accidents and spills is assigned a high hazard for the highway and a moderate hazard for the railroad. Local and county emergency response is recognized as barrier and results in a high to moderate susceptibility rating.

MANAGEMENT RECOMMENDATIONS

It should be noted that even small releases of some chemicals in close proximity to a public water supply well can have significant negative impact on water quality, and therefore are a significant threat to the public water supply. Steps can be taken to reduce the likelihood of releases in the source water for the PWS or in the vicinity of the sources. Some of these management recommendations are detailed in the susceptibility table for the Town of Plentywood PWS (Table 6). If these, and other, management recommendations are implemented; they may be considered additional barriers that will reduce the susceptibility of the intake to specific sources and contaminants.

Agricultural Best Management Practices (BMPs) – The water system should encourage local land users to utilize BMPs that address application and mixing of fertilizer and pesticides. BMPs are generally voluntary but their implementation can be encouraged through education and technical assistance.

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

Education - Educational workshops provided to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated emergency personnel would promote the efficiency and effectiveness of emergency responses to hazardous material spills. Likewise, educational workshops provided to rural homeowners and agricultural landowners will promote best management practices for groundwater protection. The EPA and the State of Montana can provide educational materials on these topics.

CHAPTER 5
MONITORING WAIVERS

WAIVER RECOMMENDATION

The Town of Plentywood PWS has a waiver for Phase 2 inorganics (which includes barium, cadmium, chromium, fluoride, mercury and selenium). The waiver allows Plentywood to collect one sample round for these constituents every 9-year cycle (the standard is one sample round per 3-year cycle). In addition, Plentywood was grandfathered under the radionuclide rule and is only required to sample once every 9-years. Based on past monitoring results and the susceptibility assessment, the Town of Plentywood PWS may be eligible for VOC waivers as well. Information on susceptibility and use waivers is provided in this section to give the PWS Operators an opportunity to consider if waivers may be feasible.

Before a susceptibility or use wavier is requested, the PWS Operators are encouraged to carefully review the following section on Monitoring Waiver Requirements. If after reviewing this section it is determined that an additional waivers are feasible, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region. Table 7 shows how identified potential contaminant sources affect the eligibility for monitoring waivers.

Table 7. Susceptibility Assessment as it relates to Waiver Eligibility for Significant Potential Contaminant Sources in the Inventory Region.

Source	Contaminant	Susceptibility	Waiver Eligibility
Agricultural land	SOCs, pathogens, nitrates, others	**Very High**	Waivers are not available for pathogens and nitrate. Chemical use may preclude waivers for some chemicals. The PWS should confirm chemical use/storage history by land parcel.
Transportation Corridors	VOCs, SOCs, petroleum products and other chemicals	**High to Moderate**	Chemical use in right-of-way may preclude waivers for some chemicals. PWS should confirm chemical use history along the right-of-way Waivers might be rescinded if a spill occurred.

MONITORING WAIVER REQUIREMENTS

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for the organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls are excluded from monitoring requirements by statewide waivers.

Use Waivers

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

Susceptibility Waivers

If a Use Waiver is not granted, a system may still be eligible for a Susceptibility Waiver, if through a vulnerability assessment it is demonstrated that the water source would not be susceptible to contamination. Susceptibility is based on prior analytical or vulnerability assessment results, environmental persistence, and transport of the contaminants, natural protection of the source, wellhead protection program efforts, and the level of susceptibility indicators (such as nitrate and coliform bacteria). The vulnerability assessment of a surface water source must consider the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of 1.0 mile as an area of investigation for the use of organic chemicals. Vulnerability assessment of spring water sources should use a minimum fixed radius of 1.0 mile as an area of investigation for the use of organic chemicals. Shallow groundwater sources under the direct influence of surface water (GWUDISW) should use the same area of investigation as surface water systems; that is, the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the point of diversion. The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical contaminants are in the area of investigation.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include will logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; time-of-travel or attenuation studies; vulnerability mapping; and the use of computerized groundwater flow and transport models. DEQ's PWS Section and DEQ's Source Water Protection Program will conduct review of an organic chemical monitoring waiver application. Other state agencies may be asked for assistance.

Susceptibility Waiver for Unconfined Aquifers

Unconfined aquifers are the most common source of usable groundwater. Unconfined aquifers differ from confined aquifers in that the groundwater is not regionally contained within relatively impervious geologic strata. As a result, the upper groundwater surface or water table in an unconfined aquifer is not under pressure that produces hydrostatic head common to confined aquifers.

Unconfined aquifers are usually locally recharged from surface water or precipitation. In general, groundwater flow gradients in unconfined aquifers reflect surface topography, and the residence time of water in the aquifer is comparatively shorter than for water in confined aquifers. Similar water chemistry often exists between unconfined groundwater and area surface water, and physical parameters and dissolved constituents can be an indicator of the hydraulic connection between groundwater and surface water. Consequently, unconfined aquifers can be susceptible to contamination by organic chemicals migrating from the ground surface to groundwater.

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration from the surface to the unconfined aquifer. The general procedures make use of a combination of site-specific information pertaining to the location and construction of the source development, monitoring history of the source, geologic characteristics of the unsaturated soil and vadose zones, and chemical characteristics of the organic chemicals pertaining to their

mobility and persistence in the environment. The zone of contribution of the unconfined groundwater source must be defined and plotted. This should describe the groundwater flow directions, gradients, and a 3-year time-of-travel. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and those nearby should be provided as well.

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GLOSSARY*

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

Alkalinity. The capacity of water to neutralize acids.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Glacial. Of or relating to the presence and activities of ice or glaciers. Also, pertaining to distinctive features and materials produced by or derived from glaciers.

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

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

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

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

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

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

Inventory Region. A source water management area for groundwater systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year groundwater travel time.

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes.

Large Capacity Septic System. Defined by Underground Injection Control regulations as an on-site septic system serving 20 or more persons.

Leaking Underground Storage Tank (LUST). A release from a UST and/or associated piping into the subsurface.

Maximum Contaminant Level (MCL). Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act to establish concentrations of contaminants in drinking water that are protective of human health.

Montana Bureau of Mines and Geology – Groundwater Information Center (MBMG/GWIC). The database of information on all wells drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

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

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

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

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

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

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

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

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

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

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

Pumping Water Level. Water level elevation in a well when the pump is operating.

Recharge Region. An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. As a source water management region, the term generally describes the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

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

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

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

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

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

Source Water Protection Areas. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply. For groundwater sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.

Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.

Standard Industrial Classification (SIC) Code. A method of grouping industries with similar products or services and assigning codes to these groups.

Static Water Level (SWL). Water level elevation in a well when the pump is not operating.

Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. herbicides and pesticides).

Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

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

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

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

Toxic Release Inventory (TRI). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.

Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.

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

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

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

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

Watershed. The region drained by, or contributing water to, a stream, lake, or other water body of water.

* With the exception of the definitions for Lacustrine, Phase II and Phase V Rules, and Standard Industrial Classification Code, definitions were adapted from EPA's Term References System (formerly known as Glossary of Selected Terms and Abbreviations) which can be found at: http://www.epa.gov/trs/index.htm . The definitions of glacial and lacustrine were taken from the Glossary of Geology by Robert L. Bates and Julia A. Jackson.

The definitions for Phase II and Phase V Rules were adapted from:

http://www.epa.gov/OGWDW/source/therule.html#PhaseII
http://www.epa.gov/OGWDW/source/therule.html#PhaseV

The definition for Standard Industrial Classification Code was adapted from:
EPA/Office of Enforcement and Compliance Assurance: Guide to Environmental Issues: Glossary of Terms & Acronyms *Term Detail*

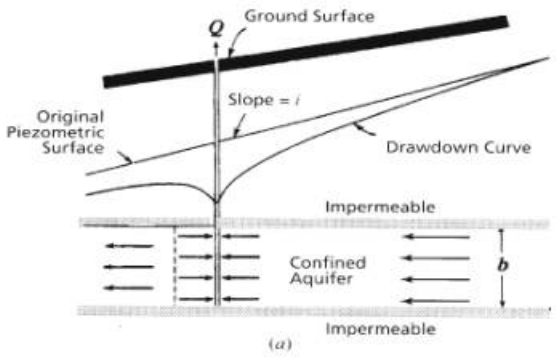
Appendix A
PWS Sanitary Survey

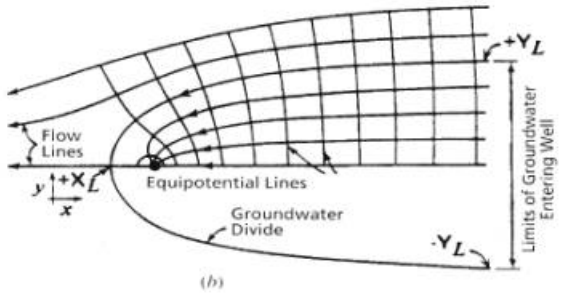
Appendix B
Background Water Quality Data

Appendix C
PWS Well Logs

Appendix D
Groundwater Time-of-Travel Calculations

Model Input





$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q}Y\right)$$

Uniform-Flow Equation

$$X_L = -\frac{Q}{2\pi Kbi}$$

Distance to Down-Gradient Null Point

$$Y_L = \pm\frac{Q}{2Kbi}$$

Boundary Limit

Legend:
- Pumping Well

Where:
Q = Well Pumping Rate
K = Hydraulic Conductivity
b = Saturated Thickness
i = Hydraulic Gradient
π = 3.1416

The values selected for the calculation of time of travel represent conservative assumptions made to identify areas that may potentially impact the Town of Plentywood PWS. The criteria for selection of each value used for this delineation are as follows:

- ***Thickness***: The value for the thickness of the aquifer is estimated at 20 feet based on the estimated thickness of the aquifer from the well logs and the screened interval.
- ***Hydraulic Conductivity***: A value for hydraulic conductivity (K) is estimated at 1x10-2 cm/sec = 28 feet/day which is in accordance with the standard range of hydraulic conductivities for unconsolidated well-sorted sands/glacial outwash (per Fetter).
- ***Hydraulic Gradient***: The hydraulic gradient was estimated based on local topography. The estimated gradient is 0.02 feet/feet.
- ***Flow Direction***: The flow direction is considered south to southeast, parallel to the creek.
- ***Porosity***: The value for effective porosity is estimated from (Todd, 1980) at 25% which is typical for sand and gravel.
- ***Pumping Rate***: The pumping rate was estimated at 750,000 gallons per day = 100,267 ft3/day based on the May 2003 sanitary survey.

Delineation Results

The results of the calculations are shown below.

			3-yr TOT	1-year TOT
Pumping Rate	**Q**	**ft3/day**	100300	100300
Hydraulic Conductivity	**K**	**ft/day**	28	28
Saturated Thickness	**b**	**ft**	20	20
Hydraulic Gradient	**I**	**ft/ft**	0.02	0.02
Effective Porosity	**n**	**%**	0.25	0.25
Distance ground water travels in Tx	**XL**	**ft**	4478	2114
Time of Travel Limit	**Tx**	**days**	**1095**	**365**
Stagnation Point	**-X**	**ft**	**-1425**	**-1425**
Lateral Flow Limit	**YL**	**ft**	**4478**	**4478**
TOT Distance Threshold	**XL**	**ft**	**4478**	**2114**
Stagnation Point	**-X**	**miles**	**-0.27**	**-0.27**
Lateral Flow Limit	**YL**	**miles**	**0.85**	**0.85**
TOT Distance Threshold	**XL**	**miles**	**0.85**	**0.40**
Average Velocity	**V**	**ft/day**	**4.09**	**5.79**

Tx = travel time from point x to a pumping well (days)

K = hydraulic conductivity (ft/day)

b = aquifer thickness (ft)

I = hydraulic gradient (ft/ft)

Q = average production rate (ft3/day)

n = effective porosity (%)

X = distance from pumping well over which groundwater travels in Tx (ft)

Null Point = distance to downgradient null point (ft)

Boundary Limit = maximum distance from the center line to the boundary of the capture zone (ft) (i.e. half the maximum width of the capture zone

Time-of-travel Calculation Method: The Time of Travel for water to move along a line parallel to the hydraulic gradient form a point to a pumping well (EPA, 1991) is Tx where:

$$T_X = \frac{n}{Ki}\left[X_L - \frac{Q}{2\pi Kbi}\ln\left(1+\frac{2\pi kbi}{Q}X_L\right)\right]$$

Appendix E
Listing of Potential Contaminant Sources in the Recharge Region

Point Source Dischargers

NPDES#	Site #	Name	Description	Receiving Water	Type
MTG580008	001	Plentywood, City Of	Facultative Sewage Lagoon	Big Muddy Creek	Municipal
MTR000079	001	Diamond B Oilfield Trucking Inc	Storm Water - Industrial	Big Muddy Creek 1/2 Mile From Prop	Storm Water

DEQ Groundwater Remediation Program Sites

Site ID: BKRP
Name: Bolke Residence
Date: 06/03/1999

DEQ UST List

http://www.deq.state.mt.us/UST/USTDownloads.asp

Notes:
Active USTs have usually been upgraded to 1998 standards (which includes leak detection and monitoring) Spills or improper handling during tank filling or product distribution at these facilities may impact the drinking water supply.

DEQ classifies inactive USTs as temporarily out of service and requires that the product in the tank be removed. However, testing of the tanks, distribution lines or soils around the tank is not required to evaluate the potential for historic leaks or spills that may impact subsurface soils and groundwater.

Alt Facility ID	Facility Name	Facility Location Address	City	County	Active Tanks	Non Active Tanks
46-01524	Auto -Tech Services	327 W 1st AVE	Plentywood	Sheridan	3	7
46-06801	Farmers Union Oil Co (Plentywood)	301 W 1st Ave	Plentywood	Sheridan	7	8
46-05200	Kum & Go Store #808	211 E 1st Ave	Plentywood	Sheridan	3	2
46-08609	Miller Oil Co (E Railroad Ave)	416 Railroad Street	Plentywood	Sheridan	4	
46-12667	MNLC Inc/Can Am Stores	203 Raymond Road	Plentywood	Sheridan	2	
46-10679	Montana Pioneer Manor Inc.	605 N Sheridan	Plentywood	Sheridan	1	1
46-06278	Sheridan County	100 W Laurel Ave	Plentywood	Sheridan	1	1
46-06279	Sheridan County Shop	Hwy 16 East	Plentywood	Sheridan	4	4
46-00795	Sheridan Memorial Hospital	440 West Laurel Avenue	Plentywood	Sheridan	1	2
46-12330	Sherwood Airport	NE Plentywood	Plentywood	Sheridan	2	
46-10540	7th Day Adventists/Private Res.	513 Laurel Ave W	Plentywood	Sheridan		1
46-08168	Ador, Harvey	Route 1, Box 1136	Plentywood	Sheridan		3
46-13396	Akins, Janet	309 S Main St	Plentywood	Sheridan		1
46-08381	Andersen, Merlin	522 E 1st Ave	Plentywood	Sheridan		1
46-11410	Anderson, Don	513 Sunnyside Ave	Plentywood	Sheridan		1
46-10272	Archer, Charles & Diane	338 N Main	Plentywood	Sheridan		1
46-10315	Arneklev, Florence	222 E 3rd Ave	Plentywood	Sheridan		1
46-11652	Bedwell, Aster	222 S Jackson	Plentywood	Sheridan		1
46-04830	Bedwell, Jim	214 N. Jackson	Plentywood	Sheridan		1
46-08568	Ben Franklin Store/Mirps Inc.	107 N Main	Plentywood	Sheridan		1
46-10950	Benson, Harold E.	437 E. 1st Avenue PO Box 362	Plentywood	Sheridan		1
46-07155	Benson, Valerie	413 N Poplar	Plentywood	Sheridan		1

Alt Facility ID	Facility Name	Facility Location Address	City	County	Active Tanks	Non Active Tanks
46-01213	Bergh, Quentin M & Beatrice	509 W Laurel	Plentywood	Sheridan		1
46-04603	Berland, Ernest	222 Highland Ave.	Plentywood	Sheridan		1
46-03621	Big M Oilfield Service Inc.	S N Railroad Ave	Plentywood	Sheridan		3
46-09624	BN Plentywood - Depot	Railroad Ave. & S. Main Street	Plentywood	Sheridan		1
46-12263	Borah, Terry	534 Williams Ave	Plentywood	Sheridan		1
46-08380	Boyer, Mabel P.	618 E. 3rd. Ave.	Plentywood	Sheridan		1
46-03782	Brensdal, Mark	523 Douglas	Plentywood	Sheridan		1
46-13002	Brockmier, Dorothy	417 W 1st Ave	Plentywood	Sheridan		1
46-12992	Bruvold, Orlando & Edna	221 N Hazel Street	Plentywood	Sheridan		1
46-00377	Carpenter, Harvey	321 Carroll St	Plentywood	Sheridan		1
46-00912	Christensen, Melvin W.	8 Mi NE	Plentywood	Sheridan		1
46-06411	Christensen, Vernon	610 William Ave	Plentywood	Sheridan		1
46-10954	Church Parsonage (Plentywood)	305 Poplar	Plentywood	Sheridan		1
46-00585	City of Plentywood	500 E Lasater	Plentywood	Sheridan		1
46-08088	Clawson, Sr Keith E.	PO Box 271	Plentywood	Sheridan		1
46-07312	Coalridge Flying Club Inc.	Sherwood Airport	Plentywood	Sheridan		1
46-07398	Corner, F. R.	309 Olive	Plentywood	Sheridan		1
46-06920	Cybulski, Ray J.	338 1st Ave W	Plentywood	Sheridan		1
46-01597	Darland, Sylvia	548 W Boundary Ave	Plentywood	Sheridan		1
46-13455	Darvis, Rick	121 N Main	Plentywood	Sheridan		1
46-11106	Desilva, Romelle	510 Box Elder	Plentywood	Sheridan		1
46-07996	Edgar & Jean Zugg	413 Hazel Street	Plentywood	Sheridan		1
46-10616	Edith Knutson Estate	337 N. Sheridan	Plentywood	Sheridan		1
46-03372	Family Chiropractic	121 N Jackson	Plentywood	Sheridan		1
46-00796	Ferguson, Aubrey J.	417 Hazel St	Plentywood	Sheridan		1
46-08391	First Congregational Church	313 N. Jackson	Plentywood	Sheridan		1
46-08564	Formerly Peterson Hardware	122 N Main	Plentywood	Sheridan		1
46-01578	Fransen, Edwin	MT Hwy 5 E PO Box 1458	Plentywood	Sheridan		1
46-03328	French, Jeanne L.	101 Hawkeye	Plentywood	Sheridan		1
46-03373	Fulkerson Funeral Home Inc.	114 W 3rd Ave	Plentywood	Sheridan		1
46-00646	Fulkerson, David G. & Jane A.	115 W 3rd Ave	Plentywood	Sheridan		1
46-01724	Fulkerson, J. F.	111 W 3rd Ave	Plentywood	Sheridan		1
46-00661	Gabrielson, Arthur	513 Box Elder St	Plentywood	Sheridan		1
46-12764	Garrick, Larry	313 N Monroe Street	Plentywood	Sheridan		2
46-08915	Gary Rueb	121 2nd Ave W	Plentywood	Sheridan		2
46-00955	Germann, Adolph H.	342 N Main	Plentywood	Sheridan		1
46-07159	Gray, Donald H.	401 Hazel Street	Plentywood	Sheridan		1
46-00151	Hansen, M. D.	406 N Monroe	Plentywood	Sheridan		1
46-04117	Heather Heights Association	Heather Heights	Plentywood	Sheridan		1
46-02679	Hibbert, Billie C.	217 N Main	Plentywood	Sheridan		1
46-07886	Hilyard, Marlo	PO Box 235	Plentywood	Sheridan		1
46-05490	Hoff, William	522 William Ave	Plentywood	Sheridan		1
46-06280	Holje, C. S.	518 Sunnyside Ave	Plentywood	Sheridan		1
46-07275	Holtan Farms	PO Box 1440	Plentywood	Sheridan		3
46-08612	Holtan, Randy	PO Box 1441	Plentywood	Sheridan		1
46-00264	Hovland, Milton	409 E. Lasater Ave.	Plentywood	Sheridan		1
46-04407	J Bar E Ranch	Address Unknown	Plentywood	Sheridan		2

Alt Facility ID	Facility Name	Facility Location Address	City	County	Active Tanks	Non Active Tanks
46-05903	Jensen, Frode A.	517 Glenwood Ave.	Plentywood	Sheridan		1
46-04244	Jensen, Gladys	609 Williams Ave.	Plentywood	Sheridan		1
46-01775	Jensen, Max	502 E Boundary Ave	Plentywood	Sheridan		1
46-03660	Jerrys Warehouse Market	804 W 1st St	Plentywood	Sheridan		2
46-07708	Johnson, Andy	PO Box 1143	Plentywood	Sheridan		2
46-10510	Johnson, Dallas and Josephine	317 N Nazel Ave	Plentywood	Sheridan		1
46-00586	Johnson, Laverne G.	PO Box 66	Plentywood	Sheridan		1
46-08581	Johnson, Mary	414 N. Poplar	Plentywood	Sheridan		1
46-10492	Johnston Pharmacy Inc.	106 N Main	Plentywood	Sheridan		1
46-05711	Johnston, Robert L.	102 Robert St PO Box 314	Plentywood	Sheridan		1
46-02759	Johnston, William and Adele	118 Roberts St	Plentywood	Sheridan		1
46-01800	Jorgensen, Henry	125 Southern Ave	Plentywood	Sheridan		1
46-07836	Kavon Farms Inc.	PO Box 453	Plentywood	Sheridan		2
46-09292	Kdr Sales & Service	Hwy 5 E Plentywood	Plentywood	Sheridan		4
46-00718	Kemp, John H.	222 N Carroll	Plentywood	Sheridan		1
46-00793	Kenneth D Collins Agency	108 E Ave	Plentywood	Sheridan		1
46-13143	Kenneth D. Collins Agency	103 Hawkeye	Plentywood	Sheridan		1
46-01498	King, Howard & Yarnett	114 N Munroe	Plentywood	Sheridan		2
46-08262	Kisler, James	230 W Laurel Ave	Plentywood	Sheridan		1
46-02657	Kleppen, Lillian	310 W Main	Plentywood	Sheridan		1
46-11295	Klofstad, Einar	209 N Jefferson St	Plentywood	Sheridan		1
46-08588	Krebsbach, Beatrice	213 E. Boundary	Plentywood	Sheridan		1
46-01884	Larry & Jane DeTienne	210 S Main	Plentywood	Sheridan		1
46-01263	Larson, Don	410 Poplar St	Plentywood	Sheridan		1
46-04490	Larson, L. A. Tony	213 N. Howard St	Plentywood	Sheridan		1
46-04815	Lasar Rice Building	640 Sunnyside Ave	Plentywood	Sheridan		1
46-07208	Lee, Arnold T.	314 S Jefferson Street	Plentywood	Sheridan		2
46-01543	Lee, Bennie	618 Glenwood Ave	Plentywood	Sheridan		1
46-01206	Lindblom, Brad	614 Sunnyside	Plentywood	Sheridan		1
46-10606	Lindblom, Leonard	214 N. Howard Street	Plentywood	Sheridan		1
46-01264	Lodahl, Leroy	503 W. Laurel Ave.	Plentywood	Sheridan		1
46-10681	Mann, David G.	PO Box 1147	Plentywood	Sheridan		1
46-03065	Marriage, Les & Dorothy	510 3rd Ave	Plentywood	Sheridan		1
46-10519	McCall, William	134 N Washington	Plentywood	Sheridan		1
46-03541	McCoy, Dale K.	PO Box 5	Plentywood	Sheridan		1
46-01600	McCoy, Kurt D.	1/2 Mi W	Plentywood	Sheridan		1
46-06283	Melle, Clara	501 Sunnyside Ave.	Plentywood	Sheridan		1
46-07413	Melle, Ralph E.	5 Mi. W. Hwy 256	Plentywood	Sheridan		1
46-07162	Michels Trucking Inc.	SW Plentywood	Plentywood	Sheridan		1
46-03252	Midby, M. C.	318 Hazel Street	Plentywood	Sheridan		1
46-08610	Miller Oil Co (Plentywood)	200 Northern Ave	Plentywood	Sheridan		6
46-08041	Miller Residence	149 Country Club Ave	Plentywood	Sheridan		1
46-01077	Mon-Dak Marine	1004 W 1st Ave	Plentywood	Sheridan		2
46-00799	Morvik, Gladys	221 W Laurel Ave.	Plentywood	Sheridan		1
46-06781	Mrs E C Friedrich	221 E 3rd Ave	Plentywood	Sheridan		1
46-04027	MT Dept Transportation (Plentywood Section)	Montana #5 Milepost 41.2	Plentywood	Sheridan		3
46-01247	Munson, Rollin G.	Sherwood Airport Box 41	Plentywood	Sheridan		2

Alt Facility ID	Facility Name	Facility Location Address	City	County	Active Tanks	Non Active Tanks
46-04438	Nathe, Dennis	218 N. Howard	Plentywood	Sheridan		1
46-10008	Neilsen, Ove J.	302 Hazel	Plentywood	Sheridan		1
46-09902	Nelson, Gary R.	216 N Main Street	Plentywood	Sheridan		1
46-10294	Nelson, Harold & Elice	210 N Poplar	Plentywood	Sheridan		1
46-07306	Newmnam, Alvin	509 Glenwood Ave	Plentywood	Sheridan		1
46-02487	Nielsen, Mitch	607 Box Elder Street PO Box 582	Plentywood	Sheridan		1
46-08447	Nielsen, Sheldon W. (N Poplar St)	417 N. Poplar St	Plentywood	Sheridan		1
46-08448	Nielsen, Sheldon W. (S Main St)	105 S Main St	Plentywood	Sheridan		1
46-01745	Nielsen, Vita	321 S Main	Plentywood	Sheridan		1
46-06867	Ok Tire Store of Plentywood	630 W 1st Ave	Plentywood	Sheridan		2
46-00584	Olson, Elsie M.	218 W Laurel Ave.	Plentywood	Sheridan		1
46-07837	One On Broadmore, Other On Main	214 N. Broadmore/223 N. Main	Plentywood	Sheridan		1
46-04405	Overby Farms	RR Box 1134	Plentywood	Sheridan		2
46-04223	Overby, Elton	501 Marron	Plentywood	Sheridan		1
46-10120	Overby, Gordon	W. 1st	Plentywood	Sheridan		1
46-00396	Overby, John A.	318 N Main	Plentywood	Sheridan		1
46-02231	Overgaard, Mildred	E. Plentywood	Plentywood	Sheridan		2
46-06500	Overland, Mike	330 N Main	Plentywood	Sheridan		1
46-11671	Peavey Company (Plentywood)	Corner of Northern & Adams St	Plentywood	Sheridan		5
46-00826	Pepsi-Cola Dist. Co.	1st Ave. W	Plentywood	Sheridan		1
46-10460	Petersen, Clarence	213 Roberts Street	Plentywood	Sheridan		1
46-01237	Peterson, Clifford W. Jr.	405 N Poplar	Plentywood	Sheridan		1
46-01262	Peterson, Clifford W. Sr.	201 N Adams	Plentywood	Sheridan		1
46-01238	Peterson's Ready To Wear	112 N Main	Plentywood	Sheridan		1
46-10876	Petrik, Curtis	401 W Boundary	Plentywood	Sheridan		1
46-00660	Plentywood Drug	119 N Main	Plentywood	Sheridan		1
46-10324	Plentywood Electric	113 N Main Street	Plentywood	Sheridan		1
46-00191	Plentywood Herald	111 W 2nd Ave	Plentywood	Sheridan		1
46-02085	Plentywood Lutheran Church	318 E 1st Ave	Plentywood	Sheridan		3
46-04430	Plentywood Masonic Temple Assoc	302 N Jackson	Plentywood	Sheridan		1
46-08585	Plentywood School Dist # 20	100 E Laurel Ave	Plentywood	Sheridan		1
46-11142	Plentywood Vet Clinic, Inc. P.C.	E of Plentywood	Plentywood	Sheridan		1
46-00794	Plw Enterprises;C/O J.Wiedebush	510 Hoover	Plentywood	Sheridan		1
46-01148	Powell, Linda M.	117 N Jefferson	Plentywood	Sheridan		1
46-01581	Prairie Ag Sales & Service	804 E 1st Ave	Plentywood	Sheridan		1
46-04821	Reeds Hereford Stock Farm	Hwy 5	Plentywood	Sheridan		2
46-04382	Rice Oil Co.	122 1st Ave E.	Plentywood	Sheridan		3
46-04786	Ritland, Gene	413 Boundary Ave.	Plentywood	Sheridan		1
46-05891	Roy's Super Value	204 N Main	Plentywood	Sheridan		1
46-01889	Ruud, Laverna	615 E 3rd Ave	Plentywood	Sheridan		1
46-07305	Sachow, Nina	213 S Adams St	Plentywood	Sheridan		1
46-00729	Sebastian, Ivan	Archer Star Route.	Plentywood	Sheridan		1
46-10604	Sebastian, Ivan D.	118 N Monroe	Plentywood	Sheridan		1
46-01860	Severson, Leonard	605 W 1st Ave.	Plentywood	Sheridan		1
46-11214	Shackelford	205 N. Poplar	Plentywood	Sheridan		1
46-06554	Sheridan Arms	300 1st Ave E	Plentywood	Sheridan		1
46-00597	Sheridan Ready Mix, Inc.	Hwy 5 W	Plentywood	Sheridan		4

Alt Facility ID	Facility Name	Facility Location Address	City	County	Active Tanks	Non Active Tanks
46-03357	Sherwood Airport	2 Mi NE of Plentywood	Plentywood	Sheridan		1
46-03941	Sherwood Airport	NE of Plentywood	Plentywood	Sheridan		1
46-03539	Shoal, Donald	518 Glenwood Ave	Plentywood	Sheridan		1
46-01219	Shuman, Thomas R.	330 W 1st Ave	Plentywood	Sheridan		1
46-01134	Smith, Robert E.	522 Box Elder	Plentywood	Sheridan		1
46-00691	Soderquist, Dale	Address Unknown	Plentywood	Sheridan		2
46-11143	Spoklie, Howard	345 N Main	Plentywood	Sheridan		1
46-02585	Spoklie, Shirley/Nyby, Diane	202 N Jackson	Plentywood	Sheridan		1
46-10581	Sprague, Alice I.	110 N Monroe	Plentywood	Sheridan		1
46-10746	St Joseph's Church	301 N Main Street	Plentywood	Sheridan		2
46-01580	Syme, Howard R.	315 N Maurice St	Plentywood	Sheridan		1
46-09281	Syme, Richard	Westby Hwy.-5 Mi. E. PO Box 1260	Plentywood	Sheridan		2
46-10656	Tange, Alfred K.	309 S Washington	Plentywood	Sheridan		1
46-04408	Tangl, Gordon	220 N Carroll	Plentywood	Sheridan		1
46-03712	Tefre, Howard	PO Box 1145	Plentywood	Sheridan		1
46-06492	Tefre, Howard	11 Miles S of Plentywood	Plentywood	Sheridan		2
46-04457	Thunim, Margaret	Address Unknown	Plentywood	Sheridan		1
46-02389	Timmerman, Florence	206 N	Plentywood	Sheridan		1
46-06107	Todd, Frank/Johnson, Crystal	526 Hill St	Plentywood	Sheridan		1
46-06780	Trinity Lutheran Church (Plentywood)	212 N Maurice Street	Plentywood	Sheridan		2
46-07757	Triple M Oil	217 W 1st Ave	Plentywood	Sheridan		3
46-01682	US Post Office (Plentywood)	115 E 2nd Ave	Plentywood	Sheridan		1
46-00583	Valley View Apartments	Douglas Ave	Plentywood	Sheridan		1
46-01483	Wagner, James W.	5 1/2 Mi NE	Plentywood	Sheridan		3
46-07118	Wang, Raymond A.	PO Box 1256	Plentywood	Sheridan		1
46-00934	Westergard, Michael N.	529 Sunnyside	Plentywood	Sheridan		1
46-03256	Western Implement	116 W 2nd Ave	Plentywood	Sheridan		1
46-00686	Williams, Oddlaug	117 N Adams	Plentywood	Sheridan		1
46-01819	Williston-Scobey Transfer	PO Box 455	Plentywood	Sheridan		2
46-04491	Wilson, C. R.	210 E. Boundry PO Box 281	Plentywood	Sheridan		1
46-11871	Young, Lowell	218 N. Adams	Plentywood	Sheridan		1
46-02143	Zeidler Hardware	105 N Main	Plentywood	Sheridan		1

DEQ LUST List

http://www.deq.state.mt.us/UST/USTDownloads.asp

City	SiteName	Location	AltEventID	Date	Confirmed Release Date	Project Officer	Active
Plentywood	Donald Bolke Residence	704 N Sheridan	4601249*4224	03-Jun-99	03-Jun-99	Aaron Anderson	Yes
Plentywood	Miller Oil Company	416 E Railroad	4608609*4287		04-Nov-03	Scott Gestring	Yes
Plentywood	Andersen, Merlin	522 E 1st Ave	4608381*1210	30-Dec-91	30-Dec-91		No
Plentywood	Auto Tech Services	327 W First Avenue	4601524*3961	11-Sep-00	10-Sep-00		No
Plentywood	Ben Franklin Store/Mirps Inc	107 N Main	4608568*3016	01-Oct-96	01-Oct-96		No
Plentywood	Berland, Ernest	222 Highland Ave.	4604603*2255	11-Jul-94	11-Jul-94		No
Plentywood	Brockmier, Dorothy	417 W 1st Ave	4613002*1522	09-Dec-92	08-Dec-92		No
Plentywood	Carpenter, Harvey	321 Carroll St	4600377*1556	17-Sep-90	17-Sep-90		No
Plentywood	Chandler, Charles Fay Sr	310 N Jefferson St	4610780*1766	26-Jul-93	25-Jul-93		No
Plentywood	Farmers Union Oil Co	301 W 1st Ave	4606801*2986	22-Aug-96	22-Aug-96		No
Plentywood	Farmers Union Oil Company	301 W 1st Ave	4606801*3115	23-Jan-97	23-Jan-97		No
Plentywood	Former Peterson Hardware	122 N Main	4608564*3177	18-Jun-97	18-Jun-97		No
Plentywood	Fulkerson, David G. & Jane A.	115 W 3rd Ave	4600646*282	24-Apr-90	24-Apr-90		No
Plentywood	Hibbert, Billie C	217 N Main	4602679*1173	02-Feb-92	27-Feb-92		No
Plentywood	Johnson, Mary	414 N. Poplar	4608581*1392	28-Sep-92	28-Sep-92		No
Plentywood	Kenneth D. Collins Agency	103 Hawkeye	4613143*2004	08-Nov-93	08-Nov-93		No
Plentywood	Kisler, James	230 W Laurel Ave	4608262*1030	05-Dec-91	05-Dec-91		No
Plentywood	Montana Pioneer Manor Inc	605 N Sheridan	4610679*3014	09-May-96	09-May-96		No
Plentywood	Newmnam, Alvin	509 Glenwood Ave	4607306*2100	05-Nov-93	05-Nov-93		No
Plentywood	Overby, Gordon	W. 1st	4610120*1869	28-Sep-93	28-Sep-93		No
Plentywood	Peavey Company	Corner of Northern & Adams St	4611671*478	28-Nov-90	27-Nov-90		No
Plentywood	Peterson's Ready To Wear	112 N Main	4601238*375	28-Aug-90	28-Aug-90		No
Plentywood	Plentywood School Dist # 20	100 E Laurel Ave	4608585*151	14-Sep-89	14-Sep-89		No
Plentywood	Plw Enterprises	510 Hoover	4600794*1822	24-Aug-93	24-Aug-93		No
Plentywood	Rice Oil Co	122 1st Ave E.	4604382*2050	23-Dec-93	23-Dec-93		No
Plentywood	Shackelford	205 N. Poplar	4611214*970	11-Oct-91	11-Oct-91		No
Plentywood	Tange, Alfred K.	309 S Washington	4610656*1335	12-Aug-92	12-Aug-92		No
Plentywood	Triple M Oil	217 West First Avenue	4607757*3949	28-Jul-00	28-Jul-00		No
Plentywood	Western Implement	116 W 2nd Ave	4603256*966	29-Oct-91	16-Oct-91		No
Plentywood	Williams, Oddlaug	117 N Adams	4600686*1048	19-Dec-91	19-Dec-91		No
Plentywood	Williston-Scobey Transfer		4601819*398	26-Sep-90	26-Sep-90		No

List of Businesses Identified by SIC Code as Potential Contaminant Sources

NAME	ADDRESS	CITY	SIC1	SIC2	SIC3	LATITUDE	LONGITUDE	Precision
A G Grain Inc	4388 Highway 16 S	Plentywood	287301	154210	519114	48.773040	-104.54562	1
Ator's Processing	Jentore	Plentywood	201104	201303		48.649920	-104.58552	1
Auto Tech Svc	327 W 1st Ave	Plentywood	554101	753801		48.775380	-104.56236	1
Burlington Northern Santa Fe	106 S Main	Plentywood	401101			48.773640	-104.55954	1
Can-Am Convenience Store	203 Raymond Rd	Plentywood	508310			48.777720	-104.56992	1
Car & Truck Exchange	210 W 1st Ave	Plentywood	551103			48.774960	-104.56074	1
Carlson Aerial Inc	NE OF Plentywood	Plentywood	734208			48.775980	-104.55816	4
Columbia Grain Intl Inc	2 Miles E Of Plentywood	Plentywood	422101			48.775980	-104.55816	4
Curtiss Farm & Auto-Carquest	203 E 1st Ave	Plentywood	553111			48.774000	-104.55744	1
D & D Sprinkler Systems	330 N Jackson St	Plentywood	526136			48.775440	-104.55678	1
Deem Photo Studio	223 W Laurel Ave	Plentywood	733501			48.778560	-104.55834	1
Diamond B Field Trucking Inc	212 Cactus St	Plentywood	138905	421306		48.775140	-104.56866	1
Farmer's Union Oil Co	301 W 1st Ave	Plentywood	519102			48.775200	-104.56170	1
Fellon's Auto Sales	113 S Jackson St	Plentywood	551103			48.772140	-104.55894	1
Fulkerson Funeral Home	114 W 3rd Ave	Plentywood	726103			48.776640	-104.55858	1
General Mills Inc	224 E Northern Ave	Plentywood	422101			48.772200	-104.55834	1
Hi-Line Homes Programs Inc	116 E 2nd Ave	Plentywood	152112			48.775440	-104.55810	1
Hi-Line Sports	558 W 1st Ave	Plentywood	594113			48.776280	-104.56530	1
Home Attendance Svc	202 E 1st Ave	Plentywood	152112			48.774060	-104.55744	1
Kdr Sales & Svc	US HIGHWAY 5 E	Plentywood	769942	508414		48.775980	-104.55816	4
Knutson's Small Engine Repair	4077 Highway 5 W	Plentywood	526137			48.774000	-104.73054	1
Kum-N-Go	211 E 1st Ave	Plentywood	541103	554101		48.774000	-104.55738	1
L & J Supply	116 Grant St	Plentywood	519112			48.774660	-104.56668	1
La Casa Personal Home Care	408 E Lasater Ave	Plentywood	799958			48.769560	-104.55564	1
M & M Trucking	PO BOX 587	Plentywood	421304			48.775980	-104.55816	4
Miller Oil	217 W 1st Ave	Plentywood	554101			48.774960	-104.56086	1
Napa Auto Parts	110 Northern Ave	Plentywood	553111			48.775980	-104.55816	4
Northern Auto Sales	626 W 1st Ave	Plentywood	551102			48.776520	-104.56626	1
Plentywood City Clerk	205 W 1st Ave	Plentywood	911104			48.774900	-104.56074	1
Plentywood Fire Dept		Plentywood	922404			48.775980	-104.55816	4
Plentywood Golf Club	709 N Sheridan St	Plentywood	799201			48.781020	-104.55906	1
Plentywood Power Equipment Co	804 E 1st Ave	Plentywood	769942			48.773100	-104.55048	1
Plentywood School	100 E Laurel Ave	Plentywood	821103			48.777420	-104.55402	1
Roger's Tire Svc	630 W 1st Ave	Plentywood	553123	753903		48.776580	-104.56632	1
Royal Carpet Cleaning	PO BOX 265	Plentywood	152114			48.775980	-104.55816	4
Rueb's Supervalu	116 W 1st Ave	Plentywood	541105			48.774540	-104.55936	1
Sheridan & Culbertson Sheet	116 E 1st Ave	Plentywood	171102			48.774360	-104.55870	1
Sheridan County Airport	NE PLENTYWOOD	Plentywood	458106	962103		48.775980	-104.55816	4
Sheridan County Clerk	100 W Laurel Ave	Plentywood	911103			48.778200	-104.55696	1
Sheridan County Clerk Of Court	100 W Laurel Ave	Plentywood	911103			48.778200	-104.55696	1
Sheridan County Road Dept Shop	4246 Highway 16 S	Plentywood	161103			48.773040	-104.54562	1

NAME	ADDRESS	CITY	SIC1	SIC2	SIC3	LATITUDE	LONGITUDE	Precision
Sheridan County School Supt	100 W Laurel Ave	Plentywood	821103			48.778200	-104.55696	1
Sheridan Memorial Hospital	440 W Laurel Ave	Plentywood	806202	805101	839998	48.778800	-104.56158	1
Tommerup Machine	Highway 16 E	Plentywood	359903			48.775980	-104.55816	4
Wildwood Park	205 W 1st Ave	Plentywood	799951			48.774900	-104.56074	1
Williston Scobey Transfer Inc	Highway 16 NW	Plentywood	421307			48.775980	-104.55816	4

Notes:

SIC- Standard Industrial Classification Code

Data Source: 1= address matched to location (most accurate), 2= located at centroid of Zip+4, 3= located at centroid of Zip+2, and 4= Zip Code Centroid (least accurate)

Reference: Select Phone Version 3.3 Phone Directory by Info USA

The U.S. Standard Industrial Classification (SIC) Codes classify categories of businesses. SIC Codes cover the entire range of business categories that exist within the economy. U.S. industries are categorized into the following divisions as represented by the first two digits of the SIC code:

- Agriculture, Forestry, and Fishing (01-09)
- Mining (10-14)
- Construction (15-19)
- Manufacturing (20-39)
- Transportation and Public Utilities (40-49)
- Wholesale Trade (50-51)
- Retail Trade (52-59)
- Finance, Insurance, and Real Estate (60-69)
- Services (70-89)
- Public Administration (90-98)
- Nonclassifiable Establishments (99)

Each SIC Code division contains a series of subcategories that cover all areas within that specific division. Detailed descriptions of each code are provided at http://www.census.gov/epcd/www/naicstab.htm.

Appendix F
Concurrence Letter