

***SOURCE WATER DELINEATION AND  
ASSESSMENT REPORT***

**Town of Lodge Grass  
Public Water Supply**

**PWSID # MT0000277**

**Date of Report: February 8, 2006**

**Revised: March 23, 2006**

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## EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared as required by the Federal Safe Drinking Water Act and in accordance with Montana's Source Water Assessment Plan. The Department of Environmental Quality (DEQ) is completing assessment and delineation reports for all public water systems in Montana. Source water assessment is the first step towards source water protection. These reports are intended to provide information and help public water system staff/operator, consumers, and community citizens develop strategies to protect drinking water sources. The information provided includes the delineation of the area most critical to maintaining safe drinking water (the inventory region), an inventory of significant potential sources of contamination within this area, and an assessment of the relative threat that these sources pose to the water system.

This PWS's uses ground water as its source of drinking water and uses two wells to provide water to its residents. One of the wells is relatively deep at 237 feet but there is no information on how this well is sealed or grouted. The other active well is 205 feet deep and is sealed to a depth of 21 feet. According to the Source Water Protection Program (DEQ, 1999), the aquifer used by this public water supply is considered to have a low sensitivity to potential contaminant sources because it is relatively deep and confined. However, due to the lack of construction information one of the active wells, and the existence of several other wells within the source water protection regions, the town's source water is considered to be vulnerable to several potential contaminant sources. The aquifer used by the town is identified as the Upper Cretaceous Judith River Formation, which is generally interpreted to be deep and confined.

As part of this assessment, three types of source water protection areas are mapped or delineated. They are: the control zone, the inventory region, and the recharge region. The control zone (sometimes called the exclusion zone) is a 100-foot radius circle around the wellhead. The goal of management in the control zone is to avoid introducing contaminants directly into the well or immediate surrounding areas. The inventory region is the area for the town's wells are delineated as 1,000 foot fixed radius circles that are used when an aquifers is interpreted to be confined (DEQ, 1999). It is assumed that both of the town's wells are completed in the confined aquifer but this may not be the case. There is little or no information about Well #4. If additional information becomes available showing the well to be completed in shallow alluvium, a new inventory region will need to be delineated. The recharge region represents the area that is expected to contribute water to the well over long periods of time. Potential sources of contamination were inventoried within the control zone and inventory region and the results are as follows:

Potential sources of contamination within the control zones of each well include portions of the parks, streets, residential lots, and parking areas. Potential contaminant sources may include: fertilizer and herbicide application in parks and lawns near the wells, infiltration of septic effluent, and leaks from city sewer mains. A federal superfund site was located in the vicinity of Well #3 near the town hall. This site is known as the Lodge Grass Drums superfund site and was cleaned up and de-listed in 1996.

The inventory region for the wells includes portions of the town with its municipal sewer lines and mains, streets, storm water drains, abandoned or unused wells, several inactive underground fuel storage sites (without leak histories), portions of the highway and rail line right-of-way, and a fuel release site known as the Cenex Livestock Haulers site. Other potential contaminant sources are located in and around town but are interpreted to be down- or cross-gradient from the town's wells and are not considered to pose a threat to the source water. This means that ground water beneath these sites is moving either away from the town's wells or moving parallel to the wells, and therefore the potential contaminant sources do not pose a threat to the town's source water or wells.

Within the recharge region only potential sources of pathogens and nitrate are evaluated or inventoried. Other types of potential contaminant sources are mentioned when they are identified within the recharge region. Potential contaminant source in the recharge region are not included in the susceptibility analysis in Chapter 4. The inventory here focuses primarily on land use patterns. The recharge region is essentially the watershed up-gradient or up-stream of the PWS. This region is dominated by agricultural land use primarily within the stream valleys. Agricultural land is considered a significant potential contaminant source. The concern here is that over application of fertilizers and/or pesticides can result in the ag-chemicals infiltrating into ground water and running off in to surface water bodies that may be hydraulically connected to aquifers. Significant potential contaminant sources within the recharge region, like irrigated ag-land, may still pose a threat over time, they are not included in the susceptibility analysis in this report. Possible management options however are included at the end of this report.

The susceptibility analysis is intended to provide the operator with information on what the greatest risk or threats to the source water are. Maps included in this report show where the potential contaminant sources that pose a threat to the source water are located relative to the public water supply wells. The assessment is focused on potential contaminant sources that the Source Water Protection Section has determined to be significant. These are detailed in Chapter 4.

Mitigating and managing some of the potential sources of contamination identified within the inventory region are often beyond the scope of what a PWS operator can accomplish or has the authority to change. The Source Water Protection Program acknowledges this and recommends that whenever possible, public water supplies work together and work with local, county, and state officials to find ways to protect source water. To this end, the Source Water Protection Program offers assistance to individual public water supplies and communities in developing source water protection plans. These plans use delineation and assessment reports like this one as a starting point to develop and implement strategies to protect source water, identify alternate sources of water, and develop emergency procedures. The plans can be developed as stand-alone documents or they can be developed as components of larger community level planning efforts.

The costs associated with contaminated drinking water are high, and prevention is vastly preferable to treatment. Public awareness is a powerful tool for protecting drinking water.

The information in this report is intended to help increase public awareness about the relationship between land use activities and drinking water quality.

## INTRODUCTION

This Delineation and Assessment Report was prepared by Jenny L. Erickson, a research assistant with the Montana Bureau of Mines and Geology, under the supervision of Jon Reiten, a Hydrogeologist with the Montana Bureau of Mines and Geology – Billings office. Jim Stimson, a Hydrogeologist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Program reviewed and edited this report. The Lodge Grass public water supply (PWS) is located in Big Horn County, Montana, about 33 miles south east of Hardin, MT ([FIGURE 1](#)). The DEQ PWS identification number, operator name, and operator number for the Lodge Grass PWS appear on the title page of this report.

### **Purpose**

This report is intended to meet the technical requirements for the completion of the source water delineation and assessment report for the Lodge Grass PWS as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to the protection of public drinking water supplies from contamination. The primary purpose of this source water delineation and assessment report is to provide information to assist the Lodge Grass PWS operator identify potential contaminant sources near and upstream from the city's wells, and to encourage the development of a source water protection plan to help protect the city's drinking water for the long term.

Delineation and assessment constitute major components of the Montana Source Water Protection Program. Delineation entails mapping the boundaries of source water protection areas, which encompass ground water and/or surface waters contributing to public water supply sources. Assessment involves identifying locations or regions within source water protection areas where contaminants may be generated, stored, transported, or disposed, and determining the relative susceptibility of drinking water to contamination from these sources.

### **Limitations**

This report was prepared to assess threats to the Lodge Grass public water supply and is based on published data including the most recent sanitary survey, and information obtained from local residents familiar with the community. The terms "drinking water supply" and "drinking water source" refer specifically to the sources of Lodge Grass's public water supply, and not any other public or private water supply. Also, not all of the potential or existing sources of groundwater or surface-water contamination in the area of Lodge Grass are identified. Only potential sources of contamination in areas that contribute water to the identified drinking water sources 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 carcinogenic or toxic constituents that do not have MCLs but are considered to be significant health threats.

# CHAPTER 1 - BACKGROUND

## The Community

Lodge Grass is located at the Crow Agency Reservation in Big Horn County and is located approximately 33 miles south of Hardin, MT and 81 miles south east of Billings, MT. Lodge Grass is less than a quarter of a mile west of the Little Bighorn River ([FIGURE 1](#) and [FIGURE 3](#)). The Chicago, Burlington & Quincy Railroad and State Highway 495 run through town. Interstate 90 is located about 1 mile east of town. The U.S. Census Bureau estimates the 2003 population of Big Horn County at 13,005 people and the town of Lodge Grass at 510 people.

Within the city limits, residents obtain their drinking water from the municipal public water supply. The municipal sewer district services all residents within city limits and some areas outside the city limits. The city is also served by a wastewater treatment plant with multi-celled lagoons located about 1 mile northeast of town. Residents in areas outlying town limits where sewer services are not available utilize on-site septic systems for waste disposal. The Town of Lodge Grass is the only public water supply in the area ([FIGURE 3](#)). Lodge Grass uses ground water as their source of water (Table 1).

**Table 1. Public Water Supplies in the Lodge Grass area.**

System Name	PWSID	Site #	Resident Users	Non-Res Users
Lodge Grass, Town of	MT0000277	WL003	450	0
Lodge Grass, Town of	MT0000277	WL004	450	0

## Climate

Based on Western Regional Climatic Center data for the period of record, annual precipitation averages 15.40 inches. Monthly average precipitation ranges from 0.76 inches in January to 2.38 inches in June. Summer thunderstorms and winter snows provide a majority of the precipitation in the area. The annual mean snowfall in Lodge Grass is 41.2 inches. A summary of the available climatic data for the Lodge Grass area is presented in Table 2 below.

**Table 2. Climate Summary**

**CROW AGENCY, MONTANA (242112)**

**Period of Record Monthly Climate Summary**

**Period of Record: 4/ 1/1898 to 7/31/1991**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.4	38.5	48.3	61.5	71.5	81.0	90.1	88.1	76.7	65.3	48.3	37.7	61.7
Average Min. Temperature (F)	5.9	10.5	20.5	30.9	40.3	48.5	53.5	50.4	41.0	31.2	19.7	10.6	30.3
Average Total Precipitation (in.)	0.76	0.68	1.08	1.67	2.39	2.38	1.05	0.96	1.53	1.25	0.87	0.76	15.40
Average Total SnowFall (in.)	7.3	6.6	8.4	3.9	0.3	0.0	0.0	0.0	0.4	1.8	5.0	7.5	41.2
Average Snow Depth (in.)	4	3	1	0	0	0	0	0	0	0	1	2	1

**Geographic Setting**

The town of Lodge Grass is located in the non-glaciated portion of the Great Plains physiographic province of North America (Rocky Mountain Association of Geologists, 1972). Topographic relief in the area is typified by gently rolling flats separated by rough broken ridges; which is largely a result of the differential erosion of the sandstones and shales. The elevation at Lodge Grass is approximately 3,400 feet above mean sea level and is approximately ¼ to ½ miles east of the Little Bighorn River ([FIGURE 3](#)). According to the DEQ Source Water Protection Program’s Mapper GIS database, the Lodge Grass PWS is located in the Little Bighorn River Hydrologic Unit; Hydrologic Unit Code 10080016.

According to the most recent sanitary survey, the water supply for the community of Lodge Grass is obtained from one relatively deep well (237 feet) and one other well that has little or no information on the depth or construction details. These wells pump to the distribution system and to a storage tank on the northwest edge of town (See [FIGURE 2](#)). From here, the water is then gravity fed through a distribution system to its customers.

Driller’s logs for some of the town’s wells and for others in the area indicate that many of the wells are completed in a consolidated bedrock aquifer consisting of multiple layers of sandstone and shale. The Montana Bureau of Mines and Geology (MBMG) identifies the formation that many of the wells are completed in as the Cretaceous age Judith River Formation. Based on the lithology and other information listed on several driller’s logs in

this area the aquifer within Judith River is interpreted to be confined. Recharge to this aquifer is primarily from subsurface flow from outside the area (Olson and Reiten, 2002). Due to the fact that the town of Lodge Grass obtains its primary drinking water from a confined, consolidated aquifer, the source water is classified as having a low source water sensitivity to contamination, in accordance with Montana Source Water Protection Program criteria (1999), also see Table 3 below.

**Table 3.** Source water sensitivity criteria (DEQ, 1999).

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

**Geology**

This section provides an overview of the geology and hydrology of the vicinity of Lodge Grass. 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 contamination sources. According to the Montana Bureau of Mines and Geology (MBMG), the public water supply wells for the town of Lodge Grass are completed in the Upper Cretaceous rocks of the Parkman Sandstone member of the

Judith River Formation (Vuke et. al, 2000). The Judith River Formation contains the Upper Member (Kju) and the Parkman Sandstone Member (Kjp) (See [FIGURE 4](#)). The Parkman Sandstone member consists of yellowish-gray to brownish-gray and olive-green, fine-to-medium-grained cross-bedded sandstone interbedded with yellowish-gray silty shale, less abundant than the sandstone. The thickness of this member is 255 feet. Water is produced from sandstone lithologies of the Parkman Sandstone and the interbedded shales form the confining beds.

The town of Lodge Grass PWS is located in the Little Bighorn River Watershed ([FIGURE 6](#)). The typical pattern is for ground-water to flow towards slopes, drains and streams. Ground-water flow is from high to low elevations. The ground-water flow for the source water of the town of Lodge Grass PWS is assumed to flow southeast towards the Little Bighorn River. Recharge to the aquifer is primarily from areas west and north of the town of Lodge Grass.

**The Public Water Supply**

The town of Lodge Grass PWS is classified as a community system under the Federal Safe Drinking Water Act, because the system serves at least 25 year-round residents through at least 15 service connections. According to the operator, this PWS services about 900 residents via approximately 235 active service connections

The most recent sanitary survey was conducted on September 9, 2003 by Mr. Matt Usereillo with the DEQ. A copy of this survey is included in Appendix D of this report. According to the sanitary survey, the City Hall Well (Well #3) was drilled to a depth of 237 feet in 1972 and has been producing water at a rate of 70 gallons per minute (gpm) consistently over the years (See [FIGURE 2](#)). The well is cased to a depth of 237 feet with 6 and 9 inch steel and PVC casing. There is no information on how this well is sealed or grouted. The static water level was recorded at 20 feet. There are no records of the well being grouted. Well #3's correct latitude and longitude is N 45.3125 and W-107.3678 (NAD 83).

The Park Well, (Well #4), is located in the city park and produces 170 gpm. According to a well log in an older sanitary survey, this well is 205 feet deep and screened from 80 to 90 feet and from 185 to 205 feet. Well #4 is sealed to a depth of 21 feet below the land surface. There is no information on the yield or production of this well. The sanitation survey notes that it is an active public water supply well and appears to be in good condition. Well #4's correct latitude and longitude is N 45.3117 and W-107.3631 (NAD 83).

The distribution system consists of 6, 8, and 10 inch PVC. Several leaks have been detected in the last year and repaired accordingly. It appears that there are several dead end mains in the system that could be a constant problem. There is also some question about the ownership and location of distribution lines through some new tribal housing near the water tank. These issues need to be discussed and resolved in order to maintain these areas properly.

According to the most recent sanitary survey, the town of Lodge Grass uses a water storage reservoir consisting of an above-ground steel tank with a capacity of 200,000 gallons. To the operator the tank has been inspected and cleaned on September 24, 2004 by Liquid Engineering Inc. However, a report from a prior visit to the system on October 31, 2000, indicates that it was inspected by IHS at some point but no records could be found. The tank appears to be in good condition although it's obvious that it is vulnerable to vandalism due to the graffiti on the side of the tank. The tank will provide water to the town for approximately 3 days should a problem with the sources occur. The reservoir is not located at a high enough elevation to provide adequate pressure without the use of booster pumps to the users on the bench when the tank volume is low. This area includes the school and tribal housing.

The following recommendations were made for the town of Lodge Grass PWS:

1. There is a place in the City Hall where vehicles can be filled with water from an overhead pipe with a hose attached to it. At the time of Mr. Usereillo's visit, the hose was connected directly to the fill pipe and was long enough to lie on the floor. This is not a good situation because the hose could be contaminated by whatever might be on the floor and then that contamination could be passed to the next person filling a tank. Contamination could then be spread from tank to tank. Also, per the Administrative Rules of Montana (ARM's), 17.38.305, current regulations require that an air gap device or a Reduced Pressure Zone (RPZ) backflow prevention assembly be installed to prevent any possibility of backflow to the public system.

According to the operator recommendation 1 was corrected on November 14, 2003. The water line in question was extended and was equipped with a reduced pressure double check valve to prevent backflow. This is mounted and attached to the wall with a ball valve fitting. In addition, the PWS provides hoses to water haulers for filling their water tanks. A special hose is used for haulers transporting drinking water. The PWS controls the use and maintenance of these hoses.

2. The City Hall Well is located in an area where vehicles could potentially run into it. The operator has painted the casing and well cap bright orange, however a fence or protective barrier of some sort should be considered because vehicles have damaged the well head in the past.

According to the operator Recommendation 2 was addressed by placing a 4 X 6 steel pipe barrier around the wellhead in the summer of 2003.

3. An issue of ownership/maintenance of an area in the distribution system that serves a number of tribal houses needs to be resolved in order to maintain the distribution system properly.

It was noted that the water system at Lodge Grass appears to be improving since past visits. Joe Lovato and any other personnel involved at the water system are to be commended for their good work and obvious dedication to the improvement of this system.

### **Lodge Grass PWS Water Quality**

Public water systems must conduct routine monitoring for contaminants in accordance with Federal Safe Drinking Water Act requirements. A community public water supply, like the town of Lodge Grass, must sample in accordance with schedules specified in the Administrative Rules of Montana (ARM). Monitoring includes coliform bacteria, lead, copper, nitrate, nitrite, volatile organic chemicals (including hydrocarbons and chlorinated solvents), inorganic chemicals (including metals), synthetic organic chemicals (including pesticides), and radiological contaminants. Transient, non-community PWSs are required to conduct routine monitoring only for pathogens (including coliform bacteria), nitrate, and nitrite. All contaminant concentrations detected in required samples must comply with numeric maximum contaminant levels (MCLs) specified in the Federal Safe Drinking Water Act.

Within the last five years, DEQ records indicate that water quality tests for bacteria have been positive on seven occasions (September 2005, August 2005, July 2005, April 2005, September 2004, October 2003, and September 2003). Records also indicate that at least two positive samples occurred in 2000. Although follow-up sampling and analyses tested negative for bacteria which indicate the water is probably not contaminated with bacteria, the number of initial detects is noteworthy and raises concern. It would be advisable to review and use proper sampling techniques, and to complete work on deficiencies noted in the previous sanitary surveys. An effort to identify and address the causes for the initial positive bacteria detects should be under taken.

No maximum contaminant level (MCL) exceedances were noted for any other constituents monitored over the past five years, this includes nitrate. The highest nitrate value recorded for the wells is 0.10 milligrams per liter (mg/l) and all other results are listed as non-detects. All of these nitrate levels are significantly below the MCL of 10 mg/l set by the U. S. EPA (Appendix B).

## CHAPTER 2 - DELINEATION

The source water protection areas for the town of Lodge Grass public water system are delineated in this chapter. The purpose of delineation is to map the land areas that contribute water to the aquifer used by the town of Lodge Grass public water supply and to define areas that help prioritize source water protection efforts. The management areas identified within the larger source water protection area included the control zone, inventory region and recharge region. The control zone is a fixed radius of 100-feet around the well. The management goal of the control zone, also known as the exclusion zone, is to protect against the direct introduction of contaminants into the wells or in the immediate area surrounding each well. The inventory region represents the zone of contribution of the well and is a fixed radius of 1,000 feet around the well. The management goal of the inventory region is to focus on pollution prevention activities at potential contaminant sources where it is likely that contaminated water would flow into the wells within a relatively short time-frame. The recharge region represents the entire portion of the aquifer that contributes water to the town of Lodge Grass water system. Management in the recharge region should focus on maintaining and improving the quality of ground water that could reach each well over longer timeframes or with increased water usage.

### **General Hydrogeologic Setting**

The Parkman Sandstone aquifer is comprised of water-saturated sandstone layers in the Judith River Formation (See [FIGURE 4](#)). The Parkman Sandstone member consists of yellowish-gray to brownish-gray and olive-green, fine-to-medium-grained cross-bedded sandstone interbedded with yellowish-gray silty shale, less abundant than the sandstone. The thickness of this member is 255 feet (Vuke et. al., 2000).

### **Local Hydrogeologic Setting and Conceptual Model**

Lodge Grass's public water supply consists of two active wells. Well #3, the City Hall Well is located in town at City Hall. Well #4, the Park Well, is located on the east side of town in the city park ([FIGURE 1](#) and [FIGURE 3](#)). Ground-water flow is generally from the west to the east. Recharge to the aquifer is primarily from areas west of Lodge Grass, from interaquifer leakage and from subsurface flow from outside the Lodge Grass area. The aquifer is confined.

### **Source Well**

Well information for the town's active wells is summarized below in Table 4. Well logs for several wells, including the active wells are included in Appendix A.

**Table 4. Information from drillers logs for the reference wells in Lodge Grass.**

MBMG #	104129	Unknown
DNRC WR#	Unknown	Unknown
	City Hall Well #3	Park Well Well #4
Location	06S 35E 13 A	06S 35E 13
Date Completed	8/19/1972	05/14/1981
Depth (ft bgs*)	237	205
Screened Interval (ft**)	Unknown	80 – 90 185 - 205
SWL Depth (ft bgs*)	20	Unknown
PWL Depth (ft bgs*)	Unknown	Unknown
Drawdown (ft**)	Unknown	Unknown
Pumping Rate (gpm***)	70	170
Specific Capacity (gpm/ft****)	Unknown	Unknown

\*ft bgs = feet below ground surface, \*\*ft = feet, \*\*\*gpm = gallons per minute, \*\*\*\*gpm/ft = gallons per minute per foot of drawdown.

**Delineation Results**

Control Zones

The control zones for each of the city wells consists of a 100 foot fixed radius circle, in accordance with the criteria specified in the Source Water Protection Program Document (1999). All potential sources of contamination are inventoried within the control zone.

Inventory Region

A source water protection area for the Lodge Grass PWS wells consist of a 1,000 foot fixed radius circle as specified in the Montana Source Water Protection Guidelines for wells completed in a confined aquifer.

Recharge Region

The Watershed Region for the Lodge Grass PWS encompasses the land area within the Little Bighorn River Hydrologic Unit. Therefore, the recharge region for the Lodge Grass PWS has been modified to include only the land area involved with recharge ([FIGURE 6](#) and

[FIGURE 7](#)). General land uses and large potential contaminant sources are inventoried in this region.

### **Limiting Factors**

There is no information on how Well #4 is grouted or sealed. This coupled with the relatively large number of positive bacteria detects recorded for this system raises concern that either some component of the storage or distribution system is makes this PWS prone to bacteria growth, or the inadequate seal is allowing water from a shallow aquifer to impact the deeper confined aquifer. Locating the original driller's log for all of the city wells could help address the concerns and limitations relating to well construction. Addressing the deficiencies identified in previous sanitary surveys would also help address questions about the water storage and distribution system.

## CHAPTER 3 - INVENTORY

An inventory of potential sources of contamination was conducted to assess the susceptibility of the Lodge Grass PWS to contamination, and to identify priorities for source water protection planning. Inventories were conducted within the control zones, combined inventory, and recharge regions. The inventory focuses on facilities that generate, use, store, transport, or dispose of potential contaminants, and on land types on which potential contaminants are generated, used, stored, transported, or disposed. Additionally, the inventory identifies potential sources of all primary drinking water contaminants and *Cryptosporidium*. Only significant potential contaminant sources were selected for detailed inventory. Potential contaminant sources in the Lodge Grass area include: city sewer and storm sewer mains, wastewater discharge points, underground- and above-ground fuel storage tanks, oil and gas test holes and wells, the Chicago, Burlington & Quincy Railroad, and State Highway 495. The majority of these potential contaminant sources are located down-gradient from the city's wells ([FIGURE 3](#)). Contaminant sources in this area are not considered to pose a threat to the source water. As a result, the inventory focuses on land areas within the inventory region and the recharge region west of Lodge Grass ([FIGURE 3](#)).

### **Inventory Method**

Available databases were initially searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. The following steps were followed:

Step 1: Land cover is identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and U.S. Environmental Protection Agency (U.S.G.S., 2000). Land cover types in this dataset were mapped from satellite imagery at 30-meter resolution using a variety of supporting information.

Step 2: EPA's Envirofacts System was queried to identify EPA regulated facilities. This system accesses the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), Permit Compliance System (PCS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility is a significant potential contaminant source.

Step 3: DEQ databases were queried to identify Underground Storage Tanks (UST), hazardous waste contaminated sites, landfills, and abandoned mines.

Step 4: A business phone directory was consulted 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 Codes.

Step 5: Major road and rail transportation routes were identified.

Step 6. All significant potential contaminant sources were identified in the inventory region and land uses and facilities that generate, store, transport, or dispose 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) Hazardous waste contaminated sites
- 4) Underground storage tanks
- 5) Major roads or rail transportation routes
- 6) Cultivated cropland
- 7) Animal feeding operations
- 8) Wastewater lagoons or spray irrigation
- 9) Septic systems
- 10) Sewered residential areas
- 11) Storm sewer outflows
- 12) Floor drains, sumps, or dry wells
- 13) Abandoned or active mines

### **Inventory Results/Control Zones**

Lodge Grass's wells are located in town and on the eastern edge of town ([FIGURE 3](#)). Control zones for the wells include portions of the parks, streets, residential lots, and parking areas. Potential contaminant sources may include: fertilizer and herbicide application in parks and lawns near the wells, infiltration of septic effluent, and leaks from city sewer mains. Information from the U.S. EPA indicates that a superfund site existed near the City Hall Well (Well #3) up until 1991. Several barrels of pesticide were stored in a garage relatively close to the well. The barrels were removed from the site in 1990 and 1991. The site was cleaned up and de-listed by EPA in 1996. Water quality samples taken from wells near the site showed no evidence of contamination from the barrels.

### **Inventory Results/Inventory Region**

The land cover information for the Lodge Grass PWS wells shows the septic density within the inventory region consisting of city sewer area with moderate areas of septic density ([FIGURE 3](#)). City sewer and the commercial / transportation land uses also are considered a potential threat to the source water due to the fact that most of these land types are served by sewer and storm water sewer mains. The main pipe lines can leak and expose ground water to a variety of contaminants including fuels and solvents (VOCs), pesticides (SOCs), wastes saturated with nitrate, metals, and household chemicals. Because the high density residential and the commercial / transportation landcover surround the wells, they could pose a threat to the source water.

Land cover information for the Lodge Grass inventory region ([FIGURE 5](#) and [FIGURE 6](#)) was summarized from the National Landcover Dataset, Montana (USGS, 2000). Land cover within the 1,000 foot fixed radius for the town of Lodge Grass inventory region includes 36% low intensity residential, 19% cropped agricultural, 17% grassland/herbaceous, 16% wetlands, 6% forest, 4% high intensity residential, and 2% shrubland. Agricultural land is considered be a significant potential contaminant source. Over application of fertilizers and/or pesticides can result in those ag-chemicals infiltrating into ground water and running off in to surface water bodies that may have hydraulic connection with aquifers that supply water. The percentage of ag-land in the

inventory region is assigned a low hazard rating in accordance with the Source Water Protection Program guidelines.

The most significant potential sources of contamination in the inventory region are summarized in Table 6. In addition to these potential sources of contamination, there is one facility listed as a former superfund site by the EPA; the Lodge Grass Drums site and another sites listed as a remediation response site; the Cenex Livestock Haulers. The locations of these facilities, relative to the PWS, are shown in [FIGURE 3](#). Both sites were mitigated and de-listed by EPA by 1996.

A known source of ground-water contamination in the Lodge Grass area is a petroleum release compensation site near the Interstate 90 ([FIGURE 3](#)). There are two facilities in the Lodge Grass area that have known releases. These include the Lodge Grass School and property adjacent to the Lodge Grass Post Office. Although these sites are listed as active, the status of remediation efforts is unknown.

A survey of the inventory region and a review of the permitted tanks listed with the DEQ indicate the presence of numerous storage tanks within the inventory region ([FIGURE 3](#)). Interstate 90 and the Chicago, Burlington & Quincy Railroad are located within the inventory region. An animal feedlot is located outside but near the inventory region. Many of the significant and non-significant potential contaminant point sources in Lodge Grass are located in town and east of the inventory region ([FIGURE 3](#)). These potential contaminant sources are considered to be cross-gradient from the cities wells and could pose a threat to the source water.

City sewer represents approximately 47% of the inventory region and could pose a threat to the source water. The Lodge Grass Wastewater Treatment Plant appears to be located approximately 1 mile north of the public water supply wells, and does not pose a threat to the public water supply.

The MBMG Ground Water Information Center (GWIC) lists multiple wells belonging to the town but it is unclear where these wells are located. Most of these wells appear to be abandoned or unused due to the fact that they are not listed on DEQ records as being part of the PWS. Some of these wells are relatively deep and appear to be completed in the same aquifer as the town's active wells. Some of these wells may be located within the town limits and possibly within the inventory regions. Unused, abandoned, or poorly constructed wells can pose a threat to the source water and the public water supply by providing pathways for shallow ground water to move in to the deeper aquifer.

In addition, Class V injection wells are listed in the inventory and could pose a threat to the source water and public water supply. Class V wells are floor drains, sometimes called "French Drains" that are not connected to a sewer system but empty directly into the shallow geologic deposits, some of which host ground water and function as aquifers. An accurate inventory of Class V injection wells has not been completed by EPA for most communities in Montana. However, because they were commonly used in the past and can pose a significant threat to the source water, they are included in the inventory.

**Table 6. Significant potential contaminant sources in the Inventory Region for the Lodge Grass**

Potential Source	ID Number On Maps	Potential Contaminants	Hazard
Lodge Grass Drums Superfund Site	Not Numbered	Pesticides (SOCs)	Site located near City Hall Well.
Old or unused Wells	Not Numbered	VOCs, and SOCs, , pathogens, nitrate, and other hazardous materials	Multiple old wells located in or near town
Municipal Sewer(About 47% of the inventory region is underlain by sewer mains)	Not Numbered	Nitrate and pathogens	Leaks resulting in Infiltration into ground water
Cultivated Cropland (19 % of the inventory region).	Not Numbered	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff
Lodge Grass-Petroleum Release (Cenex Livestock Haulers)	3	VOCs, fuels, petroleum products	Spills and leaks resulting in infiltration into ground water
Under ground fuel storage tanks (USTs)	Not Numbered	VOCs, fuels, petroleum products	Spills and leaks resulting in infiltration into ground water
Chicago, Burlington & Quincy RR	2	Inorganics, VOC's, SOC's, etc.	Contaminants leaching into ground water
Interstate 90	1	VOCs, and SOCs, , pathogens, nitrate, and other hazardous materials	Accidents and spills involving large trucks
Feedlot-Cenex Livestock Haulers	4	Nitrates and pathogens	Nitrates and pathogens leaching into ground water
Assorted businesses in town	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Releases or spills, mishandling of chemicals, improper disposal of chemicals anywhere near the river
Class V Injection Wells (existence and locations are not known) where storm and/or wastewater is concentrated and recharges groundwater.	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow infiltration of contaminants to the subsurface or to the storm water system

From the above list of potential contaminant sources, some are considered significant based upon the following factors: the volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or groundwater, and the proximity of the sources to the PWS

surface water intakes. Significant potential contaminant sources from the above list are discussed individually in the following section on susceptibility assessment and they are listed in Table 8.

**Inventory Results/Recharge Region**

Table 7 summarizes the significant potential contaminant sources that are located within the recharge region (FIGURE 6 and FIGURE 7). While these potential sources are identified, they are not included in the susceptibility analysis in the next chapter. The inventory within the Recharge Region is used to identify potential sources of pathogens and nitrate although other types of potential sources will be mentioned when they are identified. Potential contaminant sources include: Interstate 90/State Highway 87, Chicago, Burlington & Quincy Railroad, agricultural land, storm water and wastewater discharge sites, underground fuel storage tanks, wastewater treatment plant, multiple businesses in town, a confined animal feeding operation, oil and gas wells and test holes, and possibly Class V injection wells.

Predominant land covers in the Recharge Region include grassland (65%), ag-land (13%), shrubland (13%), forest (8%), and 1% wetlands (FIGURE 7). Activities on agricultural land are considered be a significant potential contaminant source within the recharge region. The concern here is that mismanagement or over application of fertilizers and/or pesticides can result in those ag-chemicals infiltrating into ground water and running off in to surface water bodies that may be in hydraulic connection with aquifers used for water supplies. Due to the large portion of the recharge region over which fertilizers and/or pesticides may be applied, the ag-chemicals are considered a potential threat to the Town of Lodge Grass PWS.

Most of the significant potential contaminant point sources in the watershed are located in town and east of the city’s wells and the inventory region (FIGURE 7). Some of these potential contaminant sources are considered to be either down-gradient from the cities wells or are far enough away from Lodge Grass so as not to pose a threat to the source water (FIGURE 7). Low septic densities occur over the largest portion of the recharge region.

**Table 7. Significant potential contaminant sources in the Recharge Region for the Lodge Grass PWS.**

Potential Source	ID Number on Maps	Potential Contaminants	Hazard
Interstate 90/State Highway87	6	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water.
Cultivated Cropland	Not Numbered	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff
Chicago, Burlington & Quincy RR	5	Inorganics, VOC’s, SOC’s, etc.	Contaminants leaching into ground water
Wastewater treatment facilities (lagoons)	2	VOCs, SOCs, pathogens, nitrate, TDS	Ongoing or catastrophic leakage of sewage into ground water

**Table 7. Significant potential contaminant sources in the Recharge Region for the Lodge Grass PWS.**

Potential Source	ID Number on Maps	Potential Contaminants	Hazard
Gas and Oil Wells	Not Numbered	Total Dissolved Solids, Petroleum Hydrocarbons	Migration of brine wastewater into shallow groundwater discharging to surface water, surface runoff to surface water
Lodge Grass - Petroleum Release	1	VOCs, fuels, petroleum products	Spills and leaks resulting in infiltration into ground water
USTs/LUSTs	3	VOCs, petroleum hydrocarbons	Spills, leaks impacting groundwater and or reaching surface water
Assorted businesses in town	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Releases or spills, mishandling of chemicals, improper disposal of chemicals anywhere near the river
Confined Animal Feeding Operation (CAFO)	1	Nitrate, pathogens	Storm water runoff, infiltration into shallow ground water.
Mining Operations (gravel pits)	Not Numbered	- variety of hazardous materials including VOC's and SOCs	Accidental spills or illegal dumping
Class V Injection Wells (existence and locations are not known) where storm and/or wastewater is concentrated and recharges groundwater.	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow infiltration of contaminants to the subsurface or to the storm water system

From the above list of potential contaminant sources, some are considered significant based upon the following factors: volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or groundwater, and the proximity of the sources to the city's wells.

### **Inventory Update**

To make this SWDAR a useful document in the years to come, the owners, manager, or the certified water system operator(s) for the public water supply should update the inventory for their 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 at least every 5 years to ensure that this report/plan stays current in the public record.

### **Inventory Limitations**

The extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data readily available through state documents, published reports, and other public sources. Documentation may not be readily available on some potential sources. As a result, all potential contaminant sources may not have been

identified. In some instances, inadequate location information precluded the inclusion of potential sources in the inventory.

## CHAPTER 4 - SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Town of Lodge Grass and Big Horn County.

The goal of source water management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the inventory region, and 3) ensuring that land use activities in the recharge region pose minimal threats 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 Lodge Grass PWS operators, city, and county officials to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the PWS well(s) (Tables 8 and 9). For point sources, hazard is rated by the proximity of a potential contaminant source to the well(s). A high hazard rating is assigned to point sources if the PWS well is not sealed through the confining layer. A moderate hazard rating is assigned to point sources if wells in the inventory region other than the PWS well are not sealed through the confining layer. A low hazard rating is assigned to point sources if all wells in the inventory region are sealed through the confining layer. Hazard ratings for non-point sources are assigned based on the following criteria in Table 8.

For the Lodge Grass PWS, the active wells are assumed to be adequately sealed based on the common practice of driller's in the area to isolate higher quality water aquifer from aquifers with lower water quality. Based on the MBMG GWIC data, there are other wells listed in the vicinity of Lodge Grass but their locations are not known. Two of these wells appear to be completed in the same aquifer as the town's wells and they do not appear to be adequately sealed. An adequate seal is one that extends into the confining layer above the producing aquifer. The seal prevents shallow ground water which is more vulnerable to contamination from moving down into deeper aquifers. Due to the fact that the wells are not properly sealed, may be unused or abandoned, and their locations relative to the town's active PWS wells, the hazard rating is set to moderate for all potential contaminant sources within the inventory regions, in accordance with the Montana Source Water Protection Program guidelines (Table 8). In some cases, one or more barriers have been identified, which lowers the final susceptibility rating (Table 10).

**Table 8. Hazard of potential contaminant sources.**

	PWS well is not sealed through the confining layer	Well(s) in the inventory region other than the PWS well are not sealed through the confining layer	All wells in the inventory region are sealed through the confining layer
<b>Point Sources of All Contaminants</b>	High	Moderate	Low
<b>Septic Systems</b>	High: > 300 Moderate: 50 – 300 Low: < 50	Moderate: > 300 Low: < 300	Low
<b>Municipal Sanitary Sewer</b> (% land use)	High: > 50 Moderate: 20 – 50 Low: < 20	Moderate: > 50 Low: < 50	Low
<b>Cropped Agricultural Land</b> (% land use)	High: > 50 Moderate: 20 – 50 Low: < 20	Moderate: > 50 Low: < 50	Low

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 saturated zone above the well intake can be natural barriers. Table 9 shows how barriers are used to adjust the final susceptibility ratings.

**Table 9. Susceptibility of Source Water based on Hazard rating and the presence of Barriers**

	High Hazard Rating	Moderate Hazard Rating	Low Hazard Rating
<b>No Barriers</b>	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
<b>One Barrier</b>	High Susceptibility	Moderate Susceptibility	Low Susceptibility
<b>Multiple Barriers</b>	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant on the following page (Table 10).

## Susceptibility Assessment Results

**Table 10. Susceptibility Assessment Of Significant Potential Contaminant Sources in the Inventory Region.**

Inventory Region							
Source	ID Number on Maps	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Old and Unused Wells (Locations are unknown)	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Leakage along well bore hole into deeper aquifers	<b>Moderate</b>	None	<b>High</b>	-Identify and locate old wells and properly abandon
Sewer Lines	Not Numbered	Nitrates and pathogens	Nitrates and pathogens	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet)	<b>Moderate</b>	Maintain Pipes Assess Leakage
USTs/LUSTs	4	VOCs, petroleum hydrocarbons	Spills, leaks impacting groundwater and or reaching surface water	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet)	<b>Moderate</b>	Carry out periodic inspections Spill response planning, tank and groundwater monitoring
Assorted businesses in town	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Releases or spills, mishandling of chemicals, improper disposal of chemicals anywhere near the river	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet)	<b>Moderate</b>	Support efforts to provide educational workshops to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Scheduled days for the collection of hazardous wastes from the public.
Cultivated Cropland (19% in the inventory)	Not Numbered	Fertilizers, pesticides, pathogens,	Spills, over-application, surface runoff		-Depth to Screened Interval (>		

**Table 10. Susceptibility Assessment Of Significant Potential Contaminant Sources in the Inventory Region.**

<b>Inventory Region</b>							
<b>Source</b>	<b>ID Number on Maps</b>	<b>Contaminant</b>	<b>Hazard</b>	<b>Hazard Rating</b>	<b>Barriers</b>	<b>Susceptibility</b>	<b>Management Recommendations</b>
region) (13% in the recharge region)		nitrate		<b>Moderate</b>  <b>Moderate</b>	100 feet)	<b>Moderate</b>  <b>Moderate</b>	Support efforts to provide educational information, materials and resources to land owners on the proper application and storage of pesticide and fertilizers; implement agricultural BMPs
Lodge Grass Drums Superfund Site	Not Numbered	Pesticides (SOCs)	Leaks resulting in chemicals infiltrating into ground water	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet) -Site has been cleaned up and de-listed in 1996	<b>Low</b>	Maintain water quality monitoring.
Lodge Grass-Petroleum Release (Cenex Livestock Haulers)	3	VOCs, fuels, petroleum products	Spills and leaks resulting in infiltration into ground water	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet) -Site has been cleaned up and de-listed in 1996	<b>Low</b>	Maintain water quality monitoring.
Wastewater treatment facilities (lagoons), sludge handling sites, or land application areas	2	VOCs, SOC, metals, pathogens, nitrates, others	Ongoing or catastrophic leakage of sewage into groundwater	<b>Moderate</b>	-Down-gradient from wells -Depth to Screened Interval (> 100 feet)	<b>Low</b>	Review permit status (contact DEQ Permitting and Compliance Water Protection Bureau – 406-444-3080 for more information) and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention and BMPs

**Table 10. Susceptibility Assessment Of Significant Potential Contaminant Sources in the Inventory Region.**

Inventory Region							
Source	ID Number on Maps	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
State Highway 87	6	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water.	<b>Moderate</b>	-Local and state emergency response -Depth to Screened Interval (> 100 feet)	<b>Low</b>	Maintain vigilant for accidents involving large vehicles Maintain emergency response plan and support training and preparation of local response personnel
Railway	5	Inorganics, VOC's, SOC's	Contaminants leaching into ground water	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet)	<b>Low</b>	Maintain vigilant for accidents involving large vehicles Maintain emergency response plan and support training and preparation of local response personnel
Storm Water / Wastewater Discharges	Not Numbered	VOCs, SOC's, pathogens, nitrate, TDS	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow discharge of contaminants with wastewater to surface water	<b>Moderate</b>	-Depth to Screened Interval (> 100 feet) -Site is down-gradient from well	<b>Low</b>	Encourage proper maintenance and operation of system; monitor leaks in system; develop an alternative treatment plan in the event of system failure
Confined Animal Feeding Operation (CAFO)	3	Nitrate, pathogens	Storm water runoff, infiltration into shallow ground water.	<b>Moderate</b>	-Site is down-gradient from well	<b>Low</b>	Continue monitoring, encourage best management practices for CAFOs

**Table 10. Susceptibility Assessment Of Significant Potential Contaminant Sources in the Inventory Region.**

Inventory Region							
Source	ID Number on Maps	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
					-Depth to Screened Interval (> 100 feet)		
Mining Operations (gravel pits)	Not Numbered	- variety of hazardous materials including VOC's and SOCs	Accidental spills or illegal dumping	<b>Moderate</b>	-Few in number and small size	<b>Low</b>	Restrict access to abandoned gravel pits, maintain vigilance for illegal dumping.
Class V Injection Wells (existence and locations are not known) where storm and/or wastewater is concentrated and recharges groundwater.	Not Numbered	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow infiltration of contaminants to the subsurface or to the storm water system	<b>Unknown</b>	<b>Unknown</b>	<b>Unknown</b>	Inventory; Provide educational information, materials and resources to business owners and the public on proper waste disposal and recycling

## Management Recommendations

It should be noted that even small releases of some chemicals in close proximity to a well can have significant negative impact on water quality, and is therefore 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 steps (considered management recommendations) are listed below.

Some management recommendations are also included in the susceptibility table for the Lodge Grass PWS (Table 10). If these, and other, management actions are implemented, they may be considered additional barriers that will reduce the susceptibility of the intake to specific sources and contaminants.

Management recommendations fall into the following categories:

- Sewer maintenance and leak detection
- Municipal sewer extension
- Agricultural best management practices
- Stormwater management
- Proper disposal and monitoring of oil and gas production wastewater
- Education
- Emergency Response Planning

***Sewer Maintenance and leak detection*** – Early warning of leaks and scheduled replacement of aging sewer lines may reduce the susceptibility of the City’s PWS to contamination from municipal septic wastes, and could also benefit other public water supplies in the Lodge Grass area.

***Sewer Extension*** – Installation of advanced septic treatment systems such as sand filters can limit contamination from new rural residential development, however, annexation and extension of sewers is the only way to reduce contamination from existing unsewered developments.

***Agricultural and silvicultural best management practices (BMPs)*** – BMPs that address application and mixing of fertilizer and pesticides are a viable alternative to prohibition of their use. BMPs may also be utilized to minimize surface runoff and soil erosion on cultivated fields. Erosion control, selective logging, and other silvicultural practices (essentially BMPs) should be considered on a county-wide basis. BMPs are generally voluntary but their implementation can be encouraged through education and technical

assistance. County planning can help promote the implementation of BMP on lands that are outside city limits but indirectly affect the city PWS.

***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 will promote the efficiency and effectiveness of emergency responses to hazardous material spills. Likewise, educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. The EPA and the State of Montana can provide educational materials on these topics.

***Hazardous Materials Collection Days*** – Several counties in the state that have vulnerable water supplies have implemented scheduled days for the collection of hazardous wastes from the public. These vary in the inclusiveness of what materials are collected, how the materials are handled, and how they are disposed of, but they all act to reduce the amount of unauthorized or improper disposal of these wastes. Used motor oil collection station could be established and available to the public on a regular basis.

***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.

## **CHAPTER 5**

# **MONITORING WAIVERS**

### **Waiver Recommendation**

It appears that Lodge Grass does not currently have any water quality waivers except for the statewide waivers that are credited to all PWSs. Diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), polychlorinated biphenyls (PCBs), cyanide and asbestos (at the source) are excluded from monitoring requirements by statewide waivers. Based on the lack of information on the well construction and water quality results for bacteria, a monitoring waiver is not recommended by the Montana Source Water Protection Program. If some of the gap in information can be filled, monitoring waivers may be appropriate. Waivers could be sought for Phase II inorganics (barium, cadmium, chromium, fluoride, mercury and selenium) and possibly Phase V inorganics (antimony, thallium, beryllium and nickel). Under this waiver, the monitoring schedule for these parameters could be reduced to every nine years, rather than every one or three years.

To be sure that eligibility for all available waivers is considered, the PWS Operators are encouraged to carefully review the following section on Monitoring Waiver Requirements. The PWS should demonstrate sufficient barriers such that the susceptibility would not change over the term of a compliance cycle, even with continued development in the area. The PWS must be in compliance with monitoring requirements to be considered. Written waiver requests must be sent to DEQ at the address below:

Greg Butts  
Montana DEQ, PWS Section  
109 Cooperative Way  
Suite 105  
Kalispell, Mt 59901

Upon receipt of a waiver request, DEQ will review the system's compliance history, historical monitoring results and source water setting. If waivers are considered appropriate, DEQ will provide the operator with application forms, guidance and technical assistance. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region. A site visit may be required to further investigate VOC and SOC use within the inventory region.

### **Monitoring Waiver Requirements**

#### Use Waivers

A Use Waiver may be granted if it is determined that target organic chemicals were/are not used, manufactured, or stored in the area of a water source. 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. 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. 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 one 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 one mile as an area of investigation for the use of organic chemicals. Surface water and shallow ground-water sources under the direct influence of surface water (GWUDISW) should assess the watershed area above the source, or a minimum fixed radius of one and one-half miles upgradient.

Given the wide range of landforms, land uses, and the diversity of ground water and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include well logs, pump test data, 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 ground-water flow and transport models. DEQ's PWS Section and 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 are not contained within impervious geologic strata. As a result, the upper ground-water surface, or water table, in an unconfined aquifer is not under the pressure that produces hydrostatic head common to confined aquifers.

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

Properly assessing a susceptibility waiver application for an unconfined source aquifer requires: 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 ground-water source must be defined and plotted. This should describe the ground-water flow directions, gradients, and a 3-year time-of-travel. All surface water 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.** An adverse health effect in which symptoms develop rapidly.

**Alkalinity.** The capacity of water to neutralize acids.

**Best Management Practices (BMPs).** Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

**Coliform Bacteria.** Bacteria found in the intestinal tracts of animals. Their presence in water is an indicator of pollution and possible contamination by pathogens.

**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 that inhibits the flow of water.

**Delineation.** A process of mapping source water management areas.

**Effective Porosity.** The percent of soil, sediment, or rock through which fluids, such as air or water, can pass. Effective porosity is always less than total porosity because fluids can not pass through all openings.

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

**Hazard.** A measure of the potential of a contaminant leaked from a facility to reach a public water supply source. Proximity or density of significant potential contaminant sources determines hazard.

**Hydraulic Conductivity.** A coefficient of proportionality describing the rate at which water can move through an aquifer.

**Inventory Region.** A source water management area that encompasses an area expected to contribute water to a public water supply well within a fixed distance or a specified groundwater time-of-travel distance.

**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.

**Nitrate.** An important plant nutrient and type of inorganic fertilizer. In water the major sources of nitrates are 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.

**Pathogens.** A bacterial organism or virus typically found in the intestinal tracts of mammals, capable of producing disease.

**Point-Source.** A stationary location or fixed facility from which pollutants are discharged.

**Porosity.** The percent of soil, sediment, or rock filled by air, water, or other fluid.

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

**SIC Code.** 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.

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

**Susceptibility (of a PWS).** The 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. 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, non-point, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

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

**Transmissivity.** The ability of an aquifer to transmit water.

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

**Volatile Organic Compounds (VOC).** Any organic compound which evaporates readily to the atmosphere (e.g. fuels and solvents).

**Recharge Region / Watershed.** The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

\* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations and other sources.

# APPENDICIES

## APPENDIX A – WELL LOGS

**Montana Bureau of Mines and Geology  
Ground-Water Information Center Site Report  
LODGE GRASS CITY OF**

[Plot this site on a topographic map](#)

### Location Information

GWIC Id: 104120  
Location (TRS): 06S 35E 13 A  
County (MT): BIG HORN  
DNRC Water Right:  
PWS Id:  
Block:  
Lot:  
Addition:

Source of Data: LOG  
Latitude (dd): 45.3147  
Longitude (dd): -107.3652  
Geomethod: TRS-TWN  
Datum: NAD27  
Altitude (feet):  
Certificate of Survey:  
Type of Site: WELL

### Well Construction and Performance Data

Total Depth (ft): 220.00  
Static Water Level (ft):  
Pumping Water Level (ft):  
Yield (gpm):  
Test Type:  
Test Duration:  
Drill Stem Setting (ft):  
Recovery Water Level (ft):  
Recovery Time (hrs):  
Well Notes:

How Drilled: UNKNOWN  
Driller's Name: JONES C.J. & W.P.  
Driller License:  
Completion Date (m/d/y): 5/5/1954  
Special Conditions:  
Is Well Flowing?:  
Shut-In Pressure:  
Geology/Aquifer: 211JDRV  
Well/Water Use: PUBLIC WATER SUPPLY

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Casing Information<sup>1</sup>

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	26.0	10.0				
0.0	143.0	8.0				

### Annular Seal Information

No Seal Records currently in GWIC.

### Completion Information<sup>1</sup>

No Completion Records currently in GWIC.

### Lithology Information

From	To	Description
0.0	4.0	SOIL
4.0	6.0	SHALE AND GRAVEL
6.0	21.0	GRAVEL AND SAND
21.0	22.0	GREY SHALE
22.0	23.0	WHITE SAND
23.0	40.0	SAND WHITE
40.0	45.0	LIGHT GREY SHALE
45.0	47.0	HARD SHELL AND SHALE
47.0	70.0	LIGHT GREY SHALE
47.0	75.0	LIGHT GREY SHALE
75.0	78.0	LIGHT GREY LIME- VERY HARD
78.0	80.0	SAME AS ABOVE
80.0	83.0	LIGHT GREY SHALE

83.0	88.0	VERY HARD
88.0	90.0	HARD SHELL
90.0	105.0	LIGHT GREY SANDY SHALE
105.0	110.0	SAME AS ABOVE
110.0	112.0	BROWN SHALE
112.0	124.0	SOFT BROWN SHALE
124.0	133.0	SOFT BROWN SHALE
133.0	135.0	HARD SANDY SHALE
135.0	140.0	SANDY SHALE DARK
140.0	142.0	SANDY SHALE DARK
142.0	143.0	HARD SHELL
143.0	145.0	HARD SHELL
145.0	150.0	SAND
150.0	160.0	WHITE SAND
160.0	168.0	BROWN SHALE
168.0	170.0	WHITE SAND
170.0	174.0	WHITE SAND
174.0	175.0	VERY HARD SHELL
175.0	185.0	SAND WHITE
185.0	190.0	WHITE SHALE SANDY
190.0	200.0	SHALE BROWN
200.0	210.0	WHITE SANDY SHALE
210.0	220.0	SANDY SHALE

**Montana Bureau of Mines and Geology  
Ground-Water Information Center Site Report  
LODGE GRASS CITY OF**

[Plot this site on a topographic map](#)

**Location Information**

GWIC Id: 104119  
Location (TRS): 06S 35E 13 A  
County (MT): BIG HORN  
DNRC Water Right:  
PWS Id:  
Block:  
Lot:  
Addition:

Source of Data: LOG  
Latitude (dd): 45.3147  
Longitude (dd): -107.3652  
Geomethod: TRS-TWN  
Datum: NAD27  
Altitude (feet):  
Certificate of Survey:  
Type of Site: WELL

**Well Construction and Performance Data**

Total Depth (ft): 230.00  
Static Water Level (ft):  
Pumping Water Level (ft):  
Yield (gpm): 100.00  
Test Type:  
Test Duration:  
Drill Stem Setting (ft):  
Recovery Water Level (ft):  
Recovery Time (hrs):  
Well Notes:

How Drilled: UNKNOWN  
Driller's Name: SIMMONS  
Driller License:  
Completion Date (m/d/y): 2/1/1945  
Special Conditions:  
Is Well Flowing?:  
Shut-In Pressure:  
Geology/Aquifer: 211JDRV  
Well/Water Use: PUBLIC WATER SUPPLY

**Hole Diameter Information**

No Hole Diameter Records currently in GWIC.

**Casing Information<sup>1</sup>**

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
0.0	48.0	10.0				STEEL
0.0	156.0	8.0				STEEL

**Annular Seal Information**

No Seal Records currently in GWIC.

**Completion Information<sup>1</sup>**

From	To	Dia	# of Openings	Size of Openings	Description
100.0	146.0	8.0			1 1/2X8 PERFS

**Lithology Information**

From	To	Description
0.0	10.0	DARK TOP SOIL
10.0	35.0	GRAVEL AND CLAY
35.0	41.0	BLUE SHALE
41.0	51.0	SANDY SHALES
51.0	71.0	GRAY SHALE
71.0	96.0	SANDY SHALE LIGHT COLOR
96.0	101.0	SANDY SHALE (DARK)
101.0	105.0	HARD SANDSTONE
105.0	150.0	COARSE SANDSTONE (BROWN) WATER
150.0	156.0	HARD ROCK
156.0	186.0	GRAY SHALE (HARD)
186.0	220.0	SANDY SHALE (HARD)
220.0	226.0	HARD SANDSTONE (WATER)
226.0	230.0	GRAY SHALE

## **Appendix B – WATER QUALITY DATA**

## **APPENDIX C - Sanitation Survey Site Plan**

**APPENDIX D - Concurrence Letter**

## **FIGURES**

[FIGURE 1 – GENERAL LOCATION MAP](#)

[FIGURE 2 – INVENTORY REGION WITH AERIAL PHOTO BASEMAP](#)

[FIGURE 3 – INVENTORY REGION](#)

[FIGURE 4 – GENERAL GEOLOGY FOR THE TOWN OF LODGE GRASS](#)

[FIGURE 5 – INVENTORY REGION LAND USE](#)

[FIGURE 6 – RECHARGE REGION LAND USE](#)

[FIGURE 7 – RECHARGE REGION INVENTORY](#)