Source Water Delineation and Assessment Report

11/99

Glendale Colony
Public Water System
PWSID # 01648

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List of Acronyms

BMP - Best Management Practices

CAFO - Confined Animal Feeding Operation

CECRA - Comprehensive Environmental Cleanup and Responsibility Act

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

LUST - Leaking Underground Storage Tank

MCL - Maximum Contaminant Level

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

MPDES - Montana Pollutant Discharge Elimination System

NPDES - National Pollutant Discharge Elimination System

PWS - Public Water System.

RCRA - Resource Conservation and Recovery Act

SMCL - Secondary Maximum Contaminant Levels

SWDAR - Source Water Delineation and Assessment Report.

SWPP - Source Water Protection Plan

SWL - Static Water Level

SOC - Synthetic Organic Compounds

TMDL - Total Maximum Daily Load

UST - Underground Storage Tank

VOC - Volatile Organic Compounds

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

1.0 INTRODUCTION

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

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

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

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

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to help public drinking water supplies protect their water source from contamination. The Montana Source Water Protection Program is responsible for completing delineation and assessment reports for all public water supplies in Montana. The Source Water Delineation and Assessment Report (SWDAR) compiles the appropriate data and other technical information about an area to allow communities to develop a source water protection plans. Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying potential contaminant sources in delineated source water protection areas, and evaluating the potential for contamination of drinking water from these sources under “worst-case” conditions such as a flood, fire or

human error. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate Glendale Colony in developing a source water protection plans that meets their specific needs.

Scope and Purpose

This report presents the source water delineation and assessments for the municipal public water supply for the Glendale Colony public water supply. James Swierc, Hydrogeologist with the Montana Department of Environmental Quality, prepared this report. Assistance was provided by Peter Wipf, operator of the public water supply for the colony.

The Glendale Colony is located in the north-central part of the Blackfeet Reservation, in Glacier County, Montana. This report is intended to meet the technical requirements for the completion of the delineation and assessment report for this PWS, as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182).

Limitations

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

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

2.0 BACKGROUND

The Community

The Glendale Hutterite Colony is located in Glacier County, in north-central Montana, as shown in Figure 1. The colony is located within the external boundaries of the Blackfeet Indian Reservation. The nearest town with commercial services is Cut Bank (population 3,519), located approximately 17 miles southeast of the colony. Browning (population 1,199), where the administrative offices of the Blackfeet Tribal government are located, is located approximately 29 miles southwest of the colony. There are approximately 125 residents at the colony. The economy of the colony relies on the production of a variety of agricultural products.

The Colony complex comprises several residential buildings, a kitchen building, and several other facilities that support the agricultural activities at the colony. A map showing the layout of the colony is included with Appendix A. The colony obtains water from several wells located at various positions near the main colony complex.

Domestic wastewater is treated in lagoons located east of the main colony buildings. Liquid waste from the lagoons is disposed by land application. Animal waste from the barns is collected into storage tanks beneath the barns. Both the liquid and solid animal waste is disposed by land application to cropland. The location of the liquid waste storage areas and the wastewater lagoon are shown in Figure 2.

Geographic Setting

Glendale Colony is located in the foothills east of the central part of the Rocky Mountain Front Range in Glacier National Park. The mountains in this area represent a significant feature with peaks that rise over 4,000 feet above the plains. The colony is located south of the Milk River drainage along an unnamed tributary in the headwaters to Big Rock Coulee, a tributary to Cut Bank Creek, the major drainage across the Blackfeet Reservation. The Cut Bank Creek watershed is part of the Marias River watershed of the Missouri River system in Montana.

The climate is typical of northern Montana, with a limited amount of precipitation averaging 11.8 inches a year as measured at the Cut Bank Airport. The wettest months are May and June averaging 1.9 and 2.7 inches a month, respectively. The driest months are October through March, with monthly averages ranging from 0.3 to 0.5 inches per month. The temperature ranges from an average high of 79.5°F in July (minimum July average of 49.9°F) to an average of 27.6°F in January (minimum January average of 6.7°F).

General Description of the Source Water

The Glendale Colony water system obtains water from five wells located within and adjacent to the main colony complex. Published information is not available characterizing the aquifer. The wells are installed to depths ranging from 100 feet to 600 feet below ground surface. Based on the information in the well logs, the source aquifer is interpreted to be a confined bedrock aquifer recharged regionally by surface water infiltration.

During recent drought conditions in 1999 to the time of preparation of this report, the system does not provide sufficient water for the colony. As a result, the colony purchases water from a supplier near Cut Bank which is transported to the colony and placed directly into the storage tank for the PWS.

Figure 1 – Location Map

The Public Water Supply

The PWS wells (Sources 002 through 006) are located near the main colony complex as shown in Figure 2. Information on the PWS for Glendale Colony is reviewed in a sanitary survey completed for the colony in June 8, 1990. The information reported on the PWS is obtained from this report, DEQ records, and from information gathered during a site visit by the author. A copy of the sanitary survey is included in Appendix A. The water system for Glendale Colony serves the resident population of 125 people through 6 active service connections located in the colony residential and other buildings. The general layout of the colony buildings and distribution system is depicted in Appendix A.

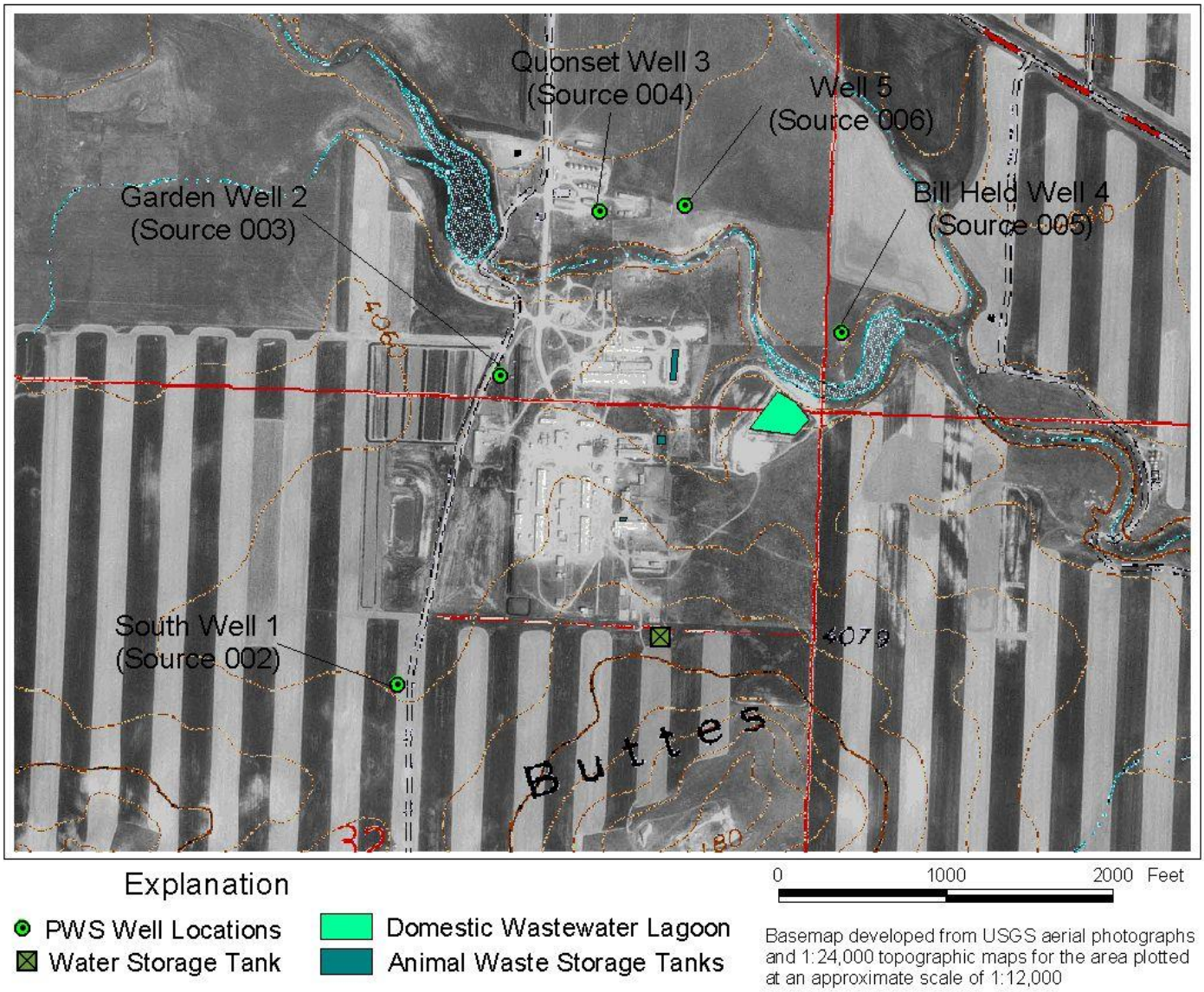

Figure 2 – Location of PWS Sources

The water from the wells is pumped from the wells to two gallon glass lined storage tanks located in a small building on the southern side of the colony. Water from the storage tank is gravity fed into the distribution system for the colony. Water used for domestic consumption is filtered with a reverse-osmosis system, prior to distribution to the buildings. There is no disinfection or other treatment system for the water.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring constituents include coliforms (as an indicator of pathogenic organism), nitrates, metals and for multiple 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. A review of the DEQ PWS database indicates that monitoring results for the Glendale Colony PWS show no violations or exceedences of any drinking water quality standards. The only detected compound that is regulated is nitrate, which can occur naturally or from agricultural, human and animal waste. The health standard for nitrates, the MCL, is 10 mg/L. A single sample from August 1999 indicated 10.5 mg/L; however, subsequent confirmation sampling did not yield any detectable concentrations. During the last five years, the monitoring results for the potable water supply indicate nitrate levels ranging from 2.07 mg/L to 7.40 mg/L.

While the detected concentrations of nitrates are generally below regulatory limits, the levels are higher than the state average for nitrates in ground water. While the detected levels may be from natural sources, the nitrates may also result from runoff from agriculture on the area to the west, upgradient from the PWS source. The levels of nitrates in the water source should represent a concern for Glendale Colony, especially if they are from agricultural sources upgradient from the colony. If the nitrate source is from agricultural activities, the source aquifer may also be threatened by trace levels of pesticides and/or herbicides that may be used in the same agricultural activities. Monitoring of water quality from the wells should be scrutinized to ensure that there are no health threats associated with use of the water by the population of Glendale Colony.

There is no readily available water quality data for ground water within the Glendale Colony area.

3.0 DELINEATION

The source water protection area, the land area that contributes water to Glendale Colony 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 for the confined aquifer is defined as the area within a 1,000-foot radius of each well. The recharge region represents the area where the source aquifer for the Glendale Colony water system wells is replenished.

Hydrogeologic Conditions
There are no readily available documents on water quality and quantity in the Cut Bank Creek watershed, including the area where Glendale Colony is located. Cannon (1996) presents an overview of water resources of the entire Blackfeet Indian Reservation, with no specific information on the area near Glendale Colony. The following discussion of the hydrologic setting of the area reflects assumptions based on basic principles of surface water hydrology. Figure 3 depicts a generalized geologic map of the area around Glendale Colony. The PWS source is from ground water in a confined bedrock aquifer.

The bedrock in the area around the PWS wells comprises the Two Medicine Formation. Water in the Two Medicine Formation typically occurs in coarser grained sandstones. These water bearing lenses are interlayered with finer grained shales and siltstones, which have only limited water bearing capacity. The well logs for the Glendale Colony wells (Appendix A) indicate that the shallow bedrock is predominantly shales, with only a limited number of thin (less than 10 feet thick) sandstones. The well logs also reflect different lithologies, suggesting that the presence of sandstones within the shales is discontinuous since individual units cannot be correlated between well locations. The database at the Montana Bureau of Mines and Geology was queried for additional wells in the area. The only wells located within a three-mile radius belong to Glendale Colony. The available well logs reflect similar lithologies for these wells. This information is summarized in Appendix B.

Recharge to the bedrock aquifer is interpreted to occur from surface water infiltration within the watershed area upgradient from the wells. As a result of the extended drought in the area, there are no perennial surface water bodies that can act as recharge units to the bedrock water system.

Ground water flow is estimated to follow topography, generally to the east following the trend of the drainage coulee. Ground water on the south side of the colony may flow with a northern component, away from the rock buttes located south of the colony (see Figure 2).

Conceptual Model and Assumptions
A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. For the Glendale Colony, ground water occurs in a confined bedrock aquifer. The aquifer is recharged by surface water infiltration from precipitation, and from any surface water present in small stock ponds. Ground water flows in a general eastward direction following topography.

Based on the hydrogeologic setting, the Glendale Colony water source is a confined aquifer in consolidated bedrock, which is considered to have a ***low*** source water sensitivity to contamination.

Well Information
The locations of the wells for the Glendale Colony are depicted in Figure 2. Information on these sources is summarized in Table 1. Copies of the driller construction logs for the wells are included with Appendix A.

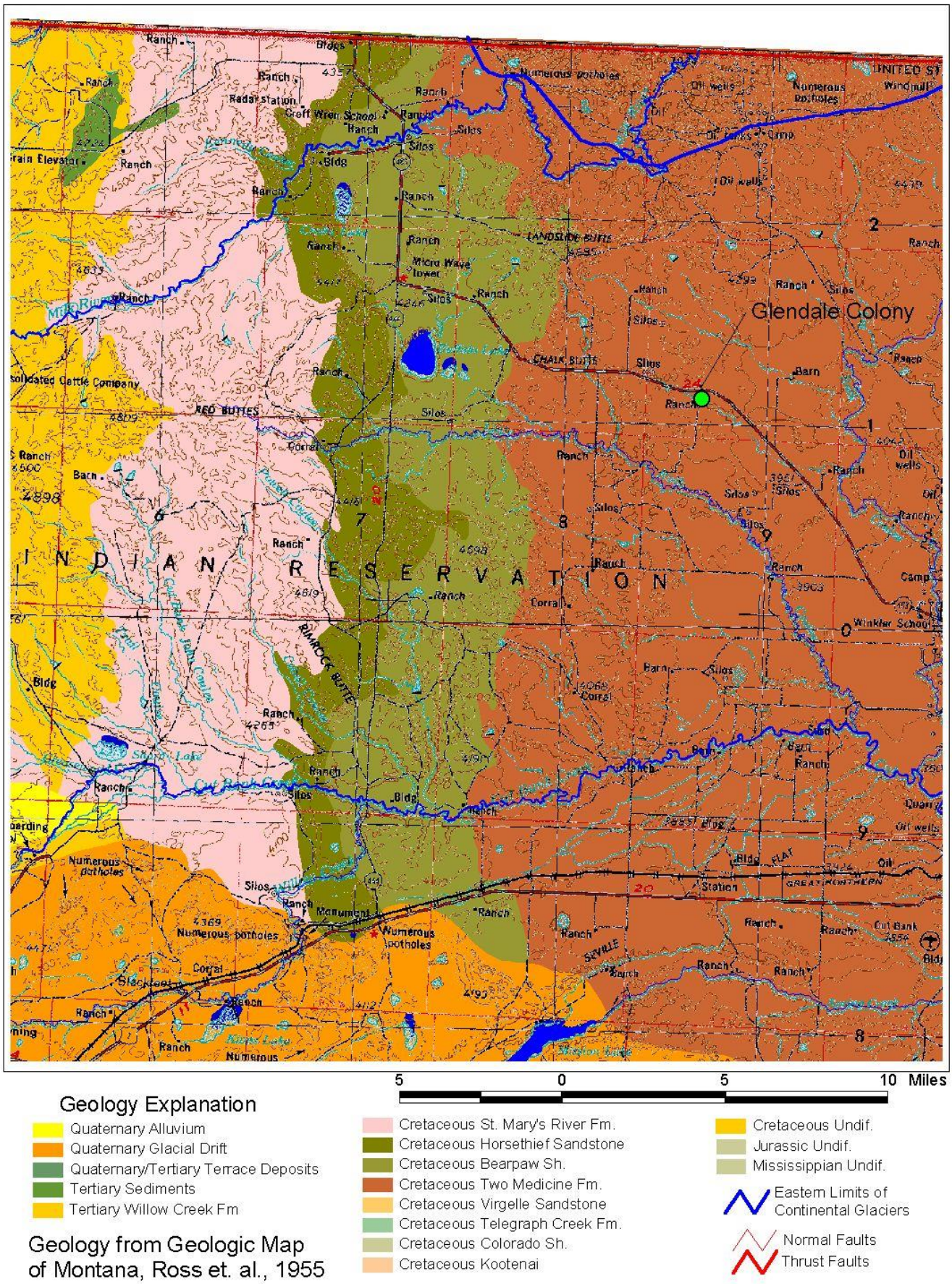

Figure 3 – Geologic Map of Study Area

Table 2 - Source Well Information for Glendale Colony.

Information	S. Well 1	Garden Well 2	Quonset Well 3	Bill Held Well 4	Well 5
PWS Source Code	002	003	004	005	006
Well Location (T, R, Sec)	T36N, R7W Sec 32 BDA	T36N, R7W Sec 29 ACA	T36N, R7W Sec 29 BDA	T36N, R7W Sec 28 CCD	T36N, R7W Sec 32 AAC
Well Location (lat, long)	48.8365°N -112.5486°W	48.8418°N -112.5461°W	48.8444°N -112.5449°W	48.8426°N -112.5377°W	48.8448°N -112.5419°W
MBMG #	89993	89976	89977	89974	89990
Water Right #	C062743	C058077	C058076	C070957	C000183
Date Well was Completed	13 Oct 1986	11 Jun 1984	16 Jul 1984	23 Jan 1989	20 Jul 1973
Total Depth	110 feet	200 feet	599 feet	180 feet	100 feet
Perforated Interval	70-110 feet	18-200 feet	57-157 feet; open hole from 176-599 feet	39-71 feet; 138-158 feet	60-100 feet
Static Water Level	36 feet	18 feet	31 feet	16 feet	40 feet
Pumping Water Level	*Not Reported*	150 feet	105 feet	40 feet	80 feet
Drawdown	*Not Reported*	132 feet	74 feet	24 feet	40 feet
Test Pumping Rate	*Not Reported*	*Not Reported*	*Not Reported*	*Not Reported*	*Not Reported*
Specific Capacity	--	--	--	--	--
Yield	35 gpm	10 gpm	7 gpm	7 gpm	*Not Reported*

Delineation Methods and Criteria

The source water protection management areas were defined for a confined aquifer in accordance with the requirements of the DEQ Source Water Protection program (DEQ, 1999). In order to support source water protection planning efforts, an informal recharge zone is delineated based on a one-mile radius around the PWS well, biased towards the area hydrologically upgradient from the wells. The complete recharge area is considered to be the Cut Bank Creek watershed area to the west (upstream) from Glendale Colony.

Source Water Protection Management Zones

The delineated management zones for the wells are depicted in Figure 4. The control zone comprises an area of a 100-foot radius around each wellhead. The inventory zone reflects an area with a 1,000-foot radius around the wellheads. The recharge area reflects the area to the west of the colony PWS wells, with a one-mile radius buffer area depicted to help with assessing susceptibility and management options.

Limiting Factors

The lack of site and regional hydrogeologic data represent the greatest potential source of error to accurate delineations of the management zones for the water sources at Glendale Colony. The recharge/inventory zone expanded to a one-mile radius provides a conservative approach that helps to minimize the potential effects from the lack of hydrologic data for the area.

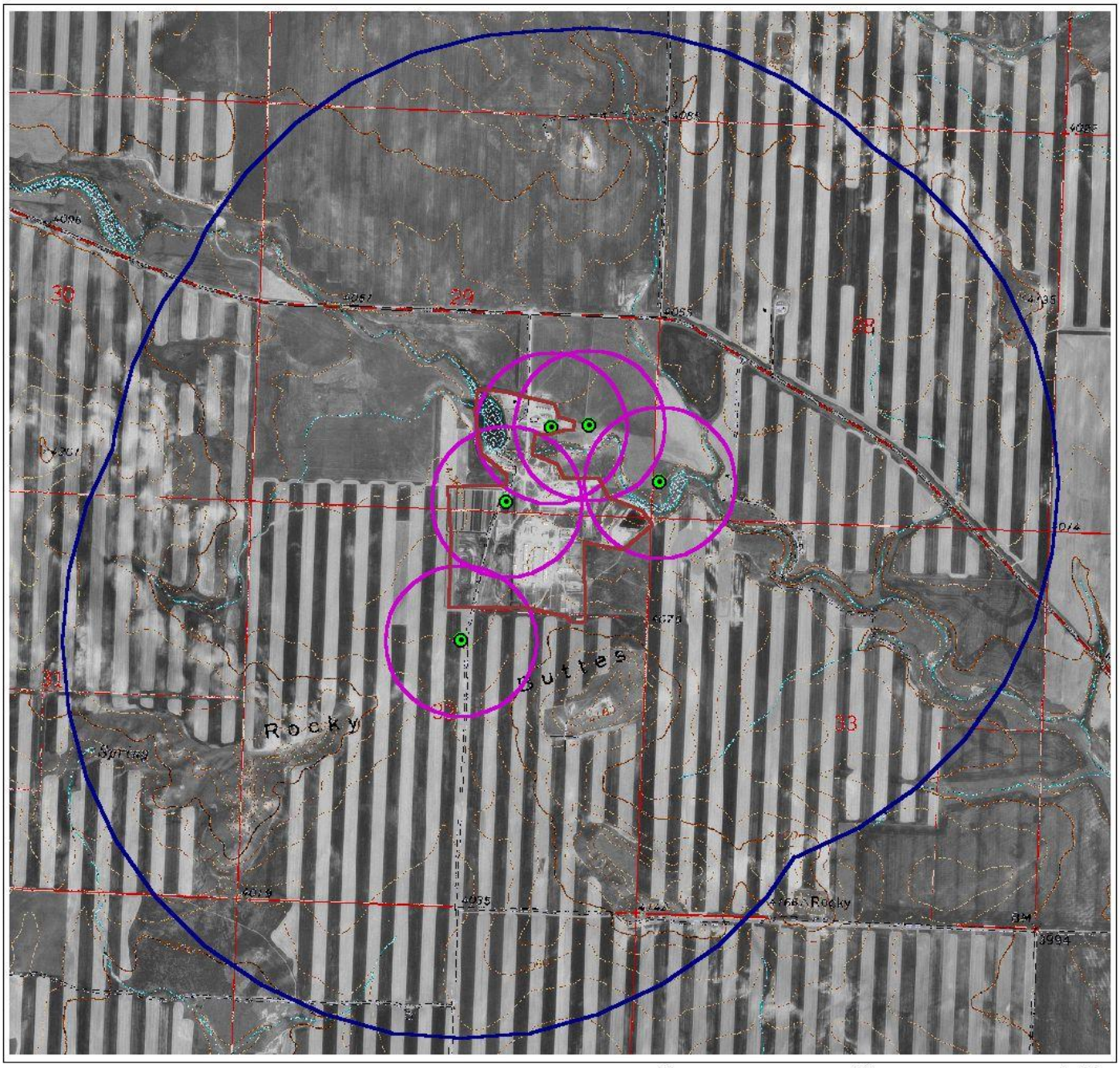

Figure 4 – Source Water Protection Management Zones

4.0 INVENTORY

An inventory of potential sources of contamination was conducted for the Glendale Colony PWS within the delineated source water protection management regions. Potential sources of all primary drinking water contaminants and Cryptosporidium were identified, however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Glendale Colony PWS management regions are nitrates, pathogens, herbicides/pesticides and fertilizer from agricultural land.

Inventory Method

The inventory for Glendale Colony was obtained by visiting the colony, and discussing colony activities with representatives from the colony. Information on the PWS, land use, agricultural chemical storage and application, and waste disposal practices were identified at this time.

Urban and agricultural land uses were identified from the United State Geological Survey land use classification project (USGS, 2000). Major transportation routes through the area, including railroad lines, were also identified. This information is depicted in Figure 5.

As part of the standard inventory process, the information in available databases on environmental sites was reviewed. EPA's Envirofacts System 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), Permit Compliance System (PCS) and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). DEQ Databases were queried to identify the following in the inventory region: Underground Storage Tanks (UST), hazardous waste contaminated sites (DEQ Hazardous Waste Cleanup Bureau), landfills, abandoned mines, and active mines including gravel pits. Any information on past releases and present compliance status was noted.

No facilities meeting these criteria were identified within any of the identified source water protection management zones.

Inventory Results/Inventory and Control Zones

The potential contaminant sources identified for the control and inventory zones for the PWS wells reflect the utilities and livestock activities within the main colony complex, and agricultural land use in the area around the colony. The potential contaminant sources are summarized in Table 2. The potential contaminant sources in the inventory zone include the colony sewer system, animal waste storage pits, spilled fuels and other farm chemicals, and crop fertilizers and herbicides. The primary hazards are leakage from the domestic sewer system or animal waste pits, spills of farm fuels or chemicals in their storage areas, spills of animal wastes during transportation to the field for land application, excess application of herbicides and runoff from the cropped areas, direct infiltration of animal waste down the wellbores, and from the actual land application of animal wastes.

The control zones around the wellheads did not have any fencing or other protection at the time of the site visit. Fencing the control zone around the wellheads is strongly recommended as a method of protecting the integrity of the wells, and preventing any contamination from surface water runoff that may infiltrate into the well through the wellbore.

Inventory Results/Recharge Region

The watershed region is comprised of agricultural cropland, with some areas used for open range cattle grazing. Fertilizers, weed control herbicides and fuels for farm machinery are the primary contaminants of concern in the recharge region.

Table 2 - Significant Potential Contaminant Sources.

Source	Hazard
Control and Inventory Zones – South Well 1 (Source 002)	
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides
Control and Inventory Zones – Garden Well 2 (Source 003)	
Fuel/Chemical Storage	Spills or Leakage of Stored Chemicals
Sewer Lines (from Housing)	Leaking Sewer Lines or Waste Collection System
Hog Barn and Waste Tank	Leaking Sewer Lines or Waste Collection System
Chicken Barn and Waste Tank	Leaking Sewer Lines or Waste Collection System
Farm Chemical Storage and Mixing Area	Waste Chemical spills
Garden Area	Spills and Excess Application of Herbicides
Control and Inventory Zones – Quonset Well 3 (Source 004)	
Hog Barn and Waste Tank	Leaking Sewer Lines or Waste Collection System
Farm Chemical Storage and Mixing Area	Waste Chemical spills
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides
Control and Inventory Zones – Bill Held Well 4 (Source 005)	
Hog Barn and Waste Tank	Leaking Sewer Lines or Waste Collection System
Domestic Sewage Lagoon	Leaking Sewer Lines or Lagoon
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides
Control and Inventory Zones – Well 5 (Source 006)	
Hog Barn and Waste Tank	Leaking Sewer Lines or Waste Collection System
Farm Chemical Storage and Mixing Area	Waste Chemical spills
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides
Recharge Area – All PWS Wells	
County Roads	Spill or Accident from Transported Chemicals or Fuels
Colonywide	Waste Chemical Spills
Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides

Inventory Update

The certified operator should update the inventory every year for his records. 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.

Inventory Limitations

The potential sources of contaminants for Glendale Colony are taken from data and reports that are readily available. Consequently, unregulated activities or unreported contaminant releases may have been missed. The use of multiple sources of data, however, should help assure that contaminant sources that are identified represent the major threats to the source water for Glendale Colony.

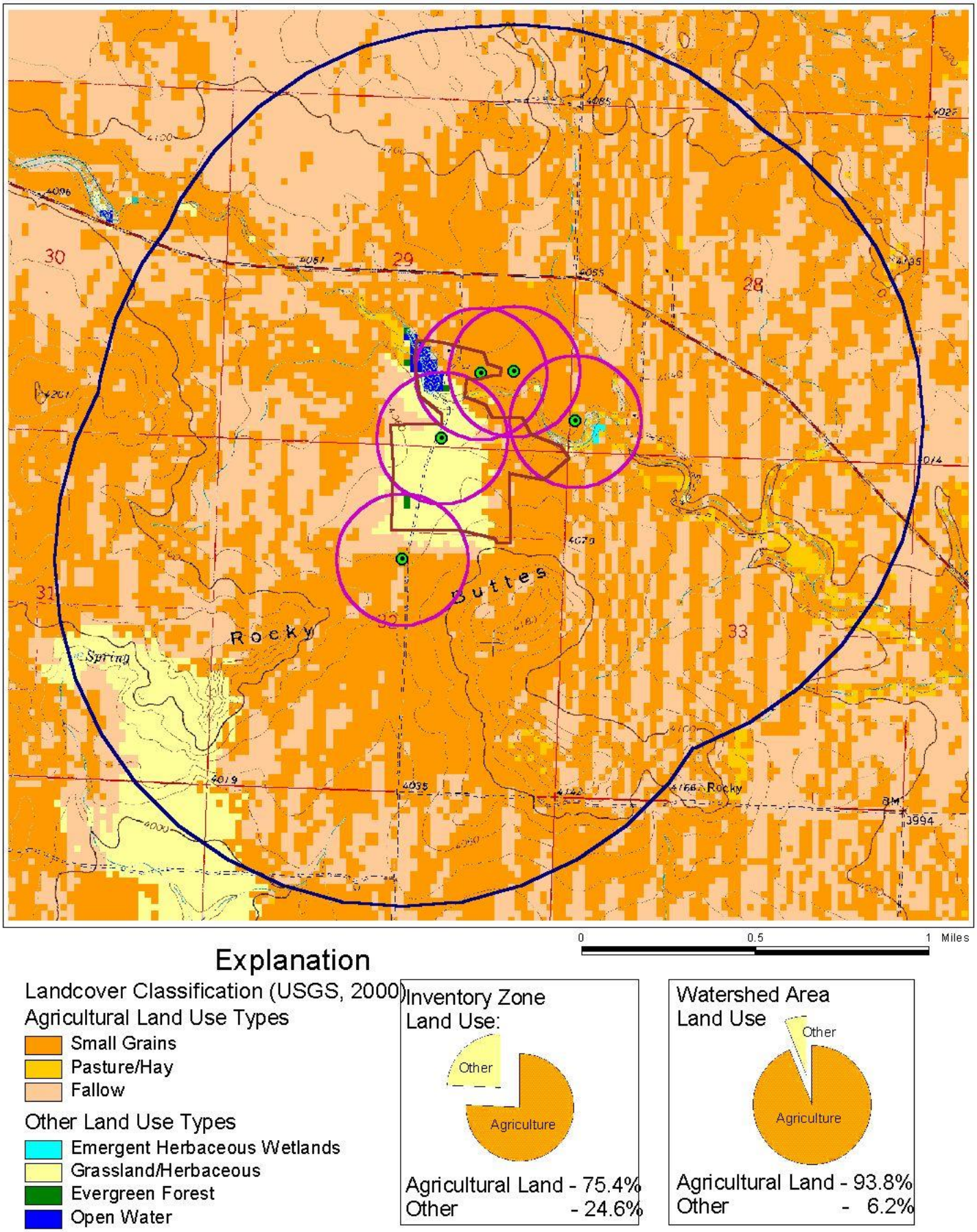

Figure 5 – Land Use Classification

5.0 SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Glendale Colony PWS.

The goal of Source Water Management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches are recommended as methods Glendale Colony can implement to reduce susceptibility of the PWS to contamination.

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 Glendale Colony PWS wells (Table 3). Hazard is rated by the proximity of the potential contaminant sources to the wells. Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant. The susceptibility of each well to each potential contaminant source is assessed separately, however, the proximity of the wells and limited number of potential contaminant sources results in both wells assessed together with the same threats.

Table 3 - Relative Susceptibility Based on Hazards 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

For confined aquifers, hazards for point sources are assigned based on the presence of other wells in the inventory zone, and how the PWS well and other wells in the area are constructed. If the PWS well is not sealed through the confining layer, than the relative hazard for any potential contaminant source within the 1,000-foot inventory area is assigned a relative hazard of high, and those within the one-mile buffer zone are assigned a relative hazard of moderate. If the PWS well has a seal through the confining layer, but other wells are present in the 1,000-foot inventory zone that do not have a seal, then the relative hazard is moderate for point sources in this area and low for potential sources within the remainder of the buffer zone. If all wells in the inventory region have effective seals through the confining layer, then the relative hazard is considered low for point sources within the 1,000-foot inventory area, and very low for other sources within the buffer zone.

For non-point sources, hazard levels are assigned based the percent of land in the inventory zone that meets the criteria listed in Table 4.

Table 4 - Non-Point Source Hazard Table

Source Type	***High Hazard***	***Moderate Hazard***	***Low Hazard***

Septic Systems	> 300 per sq. mi.	50 – 300 per sq. mi.	< 50 per sq. mi.
Municipal Sanitary Sewer (% Land Use)	> 50% of region	20% – 50% of region	< 20% of region
Cropped Agricultural Land(% Land Use)	> 50% of region	20% – 50% of region	< 20% of region

In order to assess the hazard for the well, the well database at the Ground Water Information Center at the Montana Bureau of Mines and Geology was queried. The results indicated no known wells within the Inventory Zone for the Glendale Colony. The initial hazard potential for each well is based on the completion status of the PWS wells. A review of the well completion logs for the PWS wells (Appendix A) is summarized as follows:

- For South Well 1, the well log indicates that the wellbore was to be grouted by the owner. Based on this information, the integrity of the seal is questionable; therefore all significant potential contaminant sources within the well inventory zone are classified as high.
- For Garden Well 2, the well log indicates that the wellbore was filled with cement grout to a depth of 15 feet. With a proper seal, the relative hazard of each potential contaminant source in the inventory zone is classified as low.
- For Quonset Well 3, the well log indicates that the wellbore was filled with cement grout to a depth of 18 feet. With a proper seal, the relative hazard of each potential contaminant source in the inventory zone is classified as low.
- For Bill Held Well 4, the well log indicates that the wellbore was filled with bentonite to a depth of 18 feet. With a proper seal, the relative hazard of each potential contaminant source in the inventory zone is classified as low.
- For Well 5, the well log indicates that the wellbore was not grouted. Based on this information, the integrity of the seal is questionable; therefore all significant potential contaminant sources within the well inventory zone are classified as high.

For the Glendale Colony PWS, there are no barriers identified for the agricultural activities that can reduce the susceptibility of the PWS wells to contamination under "worst-case" conditions. Implementation of best management practices, including fencing the control zones, can reduce the relative susceptibility of the system to contamination.

The results of the susceptibility assessment indicate that agricultural activities represent the only significant potential threat identified for the source water for the Glendale Colony PWS. The results are listed in Table 5.

Table 5 - Susceptibility Assessment of Significant Potential Contaminant Sources.

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Control and Inventory Zone – South Well 1 (Source 002)						
Cropped Agricultural Land	SOCs/Nitrates	Leaching and Runoff	High	BMPs for handling	High	Apply Chemicals According to Label Instructions
Control and Inventory Zone – Garden Well 2 (Source 003)						
Fuel Storage	VOCs, SOCs	Spills	Low	BMPs for Handling	Low	Recycle / Dispose of Waste Chemicals Properly
Sewer Lines (from Housing)	Pathogens and Nitrate	Leakage from sewage lines	Moderate	None	High	Monitor integrity of sewer lines
Hog Barns and Waste Tank	Pathogens and Nitrates	Spills, Infiltration	Low	None	Moderate	Dispose of Waste Outside Inventory Region
Chicken Barns and Waste Tank	Pathogens and Nitrates	Spills, Infiltration	Low	None	Moderate	Dispose of Waste Outside Inventory Region
Chemical Storage and Mixing	VOCs, SOCs	Spills	Low	BMPs for Handling	Low	Recycle / Dispose of Waste Chemicals Properly
Garden	SOCs, Pathogens and Nitrate	Spills, Infiltration	Low	BMPs for Handling	Low	Recycle / Dispose of Waste Chemicals Properly
Control and Inventory Zone – Quonset Well 3 (Source 004)						
Hog Barns and Waste Tank	Pathogens and Nitrates	Spills, Infiltration	Low	None	Moderate	Dispose of Waste Outside Inventory Region
Chemical Storage and Mixing	VOCs, SOCs	Spills	Low	BMPs for Handling	Low	Recycle / Dispose of Waste Chemicals Properly
Cropped Agricultural Land	SOCs/Nitrates	Leaching and Runoff	Moderate	BMPs for handling	Moderate	Apply Chemicals According to Label Instructions
Control and Inventory Zone – Bill Held Well 4 (Source 005)						
Hog Barns and Waste Tank	Pathogens and Nitrates	Spills, Infiltration	Low	None	Moderate	Dispose of Waste Outside Inventory Region
Domestic Sewage Lagoon	Pathogens and Nitrate	Leakage	Low	None	Moderate	Monitor operation and performance of lagoons
Cropped Agricultural Land	SOCs/Nitrates	Leaching and Runoff	Moderate	BMPs for handling	Moderate	Apply Chemicals According to Label Instructions
Control and Inventory Zone – Well 5 (Source 006)						
Hog Barns and Waste Tank	Pathogens and Nitrates	Spills, Infiltration	High	None	Very High	Dispose of Waste Outside Inventory Region
Chemical Storage and Mixing	VOCs, SOCs	Spills	High	BMPs for Handling	High	Recycle / Dispose of Waste Chemicals Properly
Cropped Agricultural Land	SOCs/Nitrates	Leaching and Runoff	Moderate	BMPs for handling	Moderate	Apply Chemicals According to Label Instructions

Table 5 - Susceptibility Assessment of Significant Potential Contaminant Sources. (cont.)

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Recharge Area – All PWS Wells						
County and Colony Access Roads	VOCs, Pathogens and Nitrate	Spills	Very Low	None	Low	Develop emergency response plan
Colonywide	VOCs, SOCs	Spills	Very Low	None	Low	Recycle / Dispose of Waste Chemicals Properly
Cropped Agricultural Land	SOCs, Nitrates	Infiltration and Runoff	High	BMPs for handling	High	Communicate with adjacent landowner, apply chemicals according to label instructions

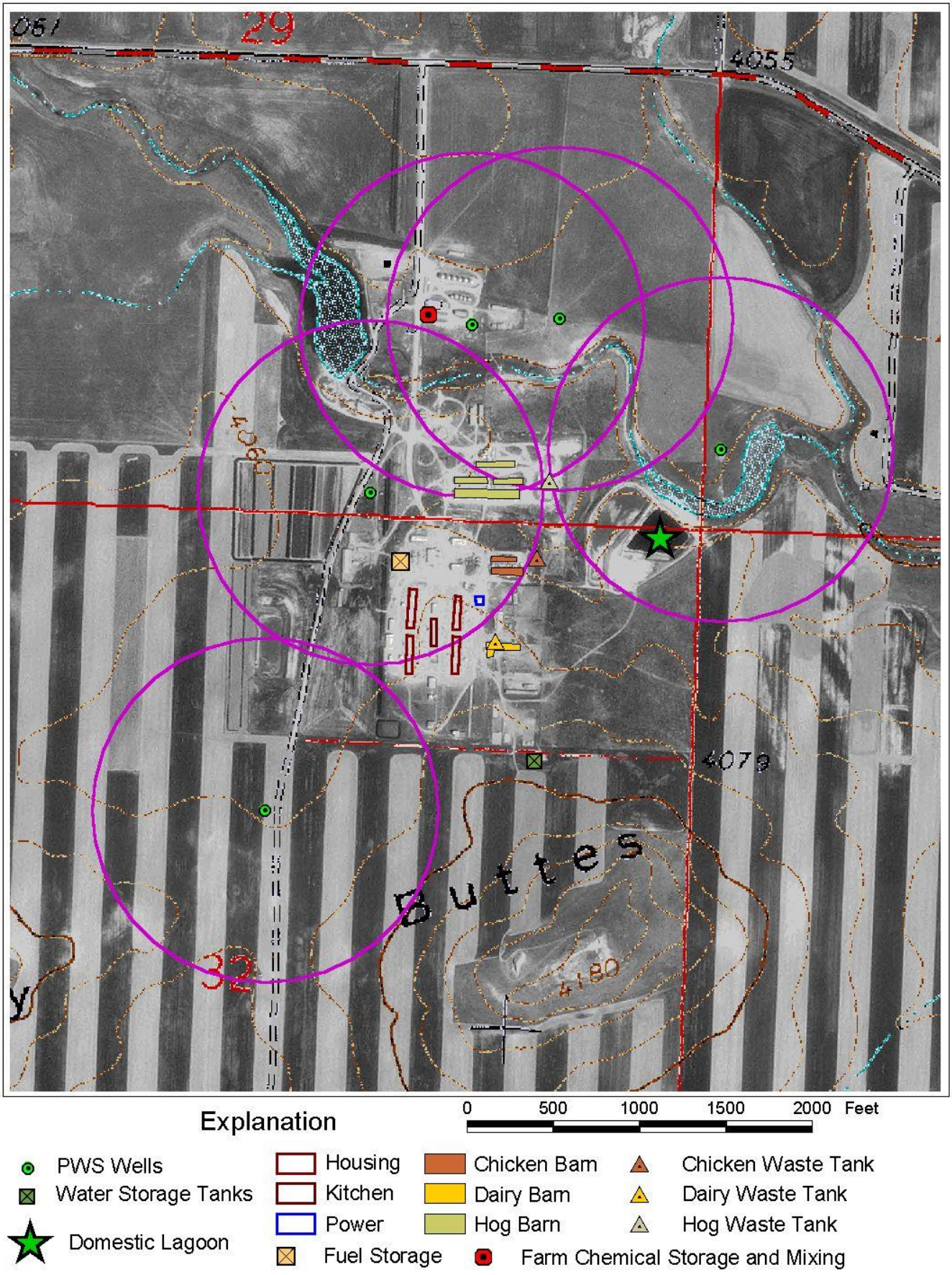

Figure 6 – Inventory Results

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