Source Water Delineation and Assessment Report

11/99

New Rockport Colony
Public Water System

PWSID # 01776

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INTRODUCTION

This Delineation and Assessment Report was completed by James Swierc with the Source Water Protection Program at the Department of Environmental Quality with the assistance of George Waldner with New Rockport Colony. This report is based partly on a Wellhead Protection Plan developed for New Rockprot Colony by Montana Rural Water Water Systems, Inc. This Source Water Delineation and Assessment Report was prepared for the New Rockport Hutterite Colony Public Water Supply, PWS ID# 1776, located in Teton County.

PURPOSE

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the New Rockport Colony 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 protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is "delineation and assessment". Delineation is a process of mapping source water protection areas, which contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information that helps the New Rockport Colony PWS complete a source water protection plan to protect its drinking water source.

Limitations

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

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

CHAPTER 1
BACKGROUND

The Community

The New Rockport Hutterite Colony is located in Teton County, in north-central Montana, as shown in Figure 1. The nearest town with commercial services is Choteau (population 1802), located approximately 11 miles southwest of the colony. There are approximately 88 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.

Domestic wastewater is treated in a lagoon treatment system located southeast of the main colony buildings. Animal wastes are temporarily stored in underflow tanks beneath the barns, and later disposed by land application. Hog waste is discharged to a lagoon holding cell located east of the central part of the colony. Wastewater and animal manure are disposed by land application to cropped areas.

Geographic setting

New Rockport Colony is located in the foothills to the east of the central part of the Rocky Mountain Front Range (see Figure 1). The mountains in this area represent a significant feature with peaks that rise over 4,000 feet above the plains. The colony is located on near the southeastern edge of the Burton Bench, an alluvial terrace of the ancestral Teton River that currently flows eastward along the southern boundary of the main colony facilities.

The climate is typical of northern Montana, with a limited amount of precipitation averaging 11.7 inches at year as measured at the Choteau Airport. The wettest months are May and June averaging 2.0 and 2.8 inches monthly, 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 82.2°F in July (minimum July average of 50.3°F) to an average of 33.5°F in January (minimum January average of 10.1°F).

General description of the Source Water

The New Rockport Colony water system uses a single well south of the main colony buildings at the location shown in Figure 1. The area is located within the Teton River watershed (USGS Hydrologic Unit Code 10030205), located within the Lower Missouri River Watershed Management Region.

The PWS well is approximately 135 feet deep. There is little information available to determine the nature of the source aquifer for the New Rockport PWS. Based on the well log (Appendix A) and regional geology, the source is interpreted to be a confined aquifer in a sand and gravel. More than 100 feet of fine-grained clays and silts cover the aquifer, acting as a confining unit. Ground water flow in the PWS source aquifer near the colony is considered likely to flow generally southeastward following topography, towards New Rockport Colony. As the water system nears the colony area, flow is considered likely to flow to the southeast towards the Teton River, where the ground water system may be in communication with the surface water body.

The Public Water Supply

The configuration of the public water supply for New Rockport Colony is outlined in the sanitary inspection report completed by McNenny Environmental Engineering and Consulting on May 11, 1995. A copy of this report is included in Appendix A. The following discussion summarizes information obtained from this report.

The water system for New Rockport Colony serves the resident population of 88 people at 5 service connections located in the colony residential and other buildings. A map showing the general layout of the colony buildings and distribution system is included in Appendix A. Water for the system is obtained from the supply well (Source 002), installed to a depth of 135 feet with casing to that depth. The system operator estimates water usage averages approximately 46,000 gallons per day, or about 32 gallons per minute.

Water from the well is treated in the well building with disinfection with sodium hypochlorite and removal of iron using a polyphosphate. After the initial treatment, the water is piped through a three-inch PVC pipe to the water storage building, where it is stored in two 21,000 gallon glass lined tanks. The storage building has a magnetic water softener system present. Water is pressurized from the storage tanks into the two-inch PVC pipes comprising the distribution system, where it is accessed at the colony buildings.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring constituents include coliforms and other signs 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 New Rockport Colony PWS show no violations or exceedences of any drinking water quality standards. The only detected regulated compound is nitrate, which can occur naturally or from human and animal waste. The health standard for nitrates, the MCL, is 10 mg/L. The monitoring results for the water supply indicate trace levels of nitrate, consistently less than 0.4 mg/L.

There is no readily available published information on water quality from the immediate vicinity of New Rockport Colony. The shallow ground water in the Burton Bench area is a calcium bicarbonate type, with generally low concentrations of dissolved constituents (Patton, 1991). This water is generally acceptable for all uses, including use as a drinking water supply source. While the Burton Bench aquifer is a different hydrogeologic unit than the source aquifer for the New Rockport PWS, the two appear to be in communication.

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to New Rockport Colony is identified in this chapter. Three management areas are identified within the source water protection area. These three regions are the control zone, inventory region, and recharge region. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region for the confined aquifer is defined as an area with a 1,000-foot radius around the wellhed. The recharge region represents the are where the aquifer that contributes water to the New Rockport Colony water system is replenished.

Hydrogeologic Conditions

There are no published reports on the hydrogeology of the immediate area around New Rockport Colony. The following discussion of the hydrogeologic setting of the area is based on Patton (1991) who evaluated the hydrogeology of the Burton Bench area north and west of the Colony. New Rockport Colony is located southeast of the boundary of the Burton Bench, and since only limited data is available on the PWS well and the hydrogeologic setting for New Rockport Colony, several assumptions are made for the hydrogeologic assessment. These assumptions are discussed in the following. A generalized geologic map of the area around New Rockport Colony, adapted from Ross et. al. (1955), is depicted in Figure 2. Additional geologic information was obtained from well logs for the area from the Ground Water Information Center at the Montana Bureau of Mines (Appendix B). The topography and surface features of the Burton Bench and surrounding area are depicted in Figure 3.

The New Rockport Colony is located at a position near the southeastern edge of the Burton Bench, a terrace gravel system derived from the drainage of the Rocky Mountains before modern times. The terraces comprise coarse grained sand and gravels, with a total thickness up to 60 feet, and are located at elevations above the modern stream alluvium. The terrace system has a thin soil cover, and contains a productive unconfined aquifer utilized where present. The gravel aquifer overlies the Cretaceous Colorado Shale bedrock unit, comprised of interlayered shale and sandstone.

The eastern limits of continental glaciation, shown in Figure 3, represent another prominent feature that effects the local geologic setting for New Rockport Colony. During this glacial period, the glaciers damned the ancestral Teton River, forming Glacial Lake Choteau in the valleys of the Teton River and its tributaries. Several well logs for shallow monitoring wells near New Rockport Colony (Appendix B) indicate that shallow, clay-rich sediments to an approximate depth of 30 feet are lacustrine strata. The source aquifer for the New Rockport Colony well is described a gravel on the well log (Appendix A), covered by silt and topsoil. Since the aquifer is unconsolidated, the gravel deposits are interpreted to represent either a localized delta deposited in the glacial lake, a glacial outwash deposit, or alluvium filling a former drainage channel, that was covered by lake sediments.

The depth to the source aquifer for the New Rockport PWS well suggests that it may be present in a channel cut into the bedrock surface in the area. Regionally, the area is mapped entirely as the Cretaceous Colorado Shale (Figure 2), with potential exposures in the walls of the Teton River valley in the area. However, the depth to the source aquifer indicates that the Teton River may not flow on a bedrock surface near New Rockport Colony. Since the shale bedrock is expected to be present at relatively shallow depths below the ground surface in the area, the total depth of the PWS well suggests that it may be present in a former drainage channel incised into the Colorado Shale bedrock surface. After formation, the channel filled with the material that now represents the source aquifer for the New Rockport Colony PWS; which was later part of Glacial Lake Choteau resulting in the clay and silt sediments covering the aquifer.

A well installed by New Rockport Colony in 1995 to a depth of 118 feet (Appendix B) reports a static water level of 40 feet below ground surface. The ground surface of the colony is approximately 100 feet above the level of the Teton River southeast of the colony. Based on this information, the hydraulic head from the source aquifer is well above the river level, suggesting that the source aquifer likely discharges into the Teton River. Based on this criteria, ground water is interpreted to flow in a direction perpendicular to the Teton River through New Rockport Colony, or generally to the southeast.

The recharge area for the aquifer is not well understand since there is little information on the geometry of the unit. Recharge is considered likely to occur from infiltration of surface water and from the Burton Bench aquifer upgradient from New Rockport Colony. If the source aquifer is present in a channel shape, the geometry of the unit needs to be understood to determine the recharge area. For purposes of this assessment, the recharge area is considered to be the area north of the Teton River west of the Colony, to the northern limits of the Burton Bench, as shown in Figures 2 and 3.

Since the aquifer is an unconsolidated unit filling a buried river channel, and the geometry of the aquifer and confining unit is not well understood, the source aquifer is considered to comprise a semi-consolidated valley fill sediments. Based on this simplified assumption, the aquifer is considered to have a ***moderate*** sensitivity to contamination.

Conceptual Model and Assumptions

The source aquifer for the New Rockport water system is comprised of a gravel deposit confined by overlying deposits of silts and clays from Glacial Lake Choteau. Ground water in the confined aquifer is recharged from infiltration of water from surface water and from terrace alluvium northwest of New Rockport Colony. In the area near New Rockport Colony, ground water flows in a generally southeastern direction, perpendicular to the Teton River, where it discharges. This relationship is depicted in Figure 4, a generalized geologic cross section of the area.

Well(s) Information

The well log for the primary well for the New Rockport PWS includes only limited information on the lithology and well construction criteria for the well. The well is estimated at 145 feet deep, with 4-inch steel casing to 135 feet. According to the operator of the colony PWS, the well pumps at approximately 35 gpm, but is capable of yielding up to 70 gpm.

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). Due to the lack of local hydrogeologic data allowing for identification of the specific recharge are for the aquifer, an informal recharge zone is delineated based on a one-mile radius around the colony, biased towards the area hydrologically upgradient from the colony well. The complete recharge area is delineated as the Burton Bench, and the area between the Burton Bench and the Teton River upstream from the colony.

Delineation Results

The delineated management zones for the wells are depicted in Figure 5. The control zones comprise an area of a 100-foot radius around the wellheads. The inventory zone reflects an area with a 1,000-foot radius around the wellheads, biased to the west and north of the colony. The recharge area reflects the area to the north and east of the colony, with a one-mile radius area depicted to help with assessing susceptibility and management options.

Table 1. Source well information.

Information	Well
PWS Source Code	002
Well Location	T24N, R3W, Sec 5
MBMG #	*Not available*
Water Right #	*Not available*
Date Well was Completed	1950
Total Depth	Est. 145 feet
Perforated Interval	Casing to 135 feet
Static Water Level	*Est. 40 feet*
Pumping Water Level	*Not available*
Drawdown	*Not available*
Test Pumping Rate	*Not available*
Specific Capacity	*Not available*

As a tool to support source water protection planning for New Rockport Colony, ground water flow rates are conservatively estimated using the uniform flow equation. The data used for the assessment, assumptions and calculation summaries are included in Appendix C. Based on these estimates, ground water flow rates are an estimated 3,150 feet (0.6 miles) for a one year time of travel, and 9,250 feet (1.75 miles) for a three year time of travel.

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 New Rockport Colony. The inventory zone of a one-mile radius provides a conservative approach that helps to minimize the potential effects from the lack of hydrologic data for the area.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for the New Rockport Colony PWS within the control and inventory 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 New Rockport Colony PWS inventory region are nitrates and pathogens from the colony wastewater treatment systems and agricultural activities; and herbicides and pesticides from cropped agricultural land.

The inventory for the New Rockport Colony PWS focuses on all activities in the control zone, certain sites or land use activities in the inventory region, and general land uses and large facilities in the recharge region.

Inventory Method

The inventory for New Rockport 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. Specific locations of relevant facilities were identified on an engineering design map of the layout of the colony systems, provided to DEQ by the colony. A copy of this map is included in Appendix A.

Urban and agricultural land uses were identified from the University of Montana GAP landuse analysis project (Redmond et. al., 1998). Major transportation routes through the area, including railroad lines, were also identified. This information is depicted in Figure 6.

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 site cleanup bureau), landfills , abandoned mines, and active mines including gravel pits. Any information on past releases and present compliance status was noted.

No facilities were identified with this search.

Inventory Results/Control Zone

The control zone for the PWS well includes the primary well house and surrounding area for livestock. The control zone for the wells is not specifically fenced for protection, but is included in a livestock corral.

Inventory Results/Inventory Region

The inventory region for the PWS wells includes the cropland area west of the wells, and part of the corral and stock management area on the farm complex. A duck pond, visible on the aerial photograph of the colony (Figure 7) has been abandoned from use, and is not present at this time. Part of the colony garden is also within the inventory zone. The location of the well away from the central part of the colony, results in the majority of the complex structures located outside of the inventory area. The colony buildings and process areas are depicted in Figure 7, with their location relative to the PWS well and the inventory zone.

Potential contaminants sources to the PWS wells, as identified in the inventory zone, include animal wastes, and herbicides. The primary hazards are excess application of herbicides and runoff from the cropped areas, as summarized in Table 2.

Inventory Results/Recharge Region

The recharge region for the PWS well is primarily agricultural cropland, with some areas used for open range cattle grazing. Use of weed control herbicides and fuels for farm machinery are the contaminants of concern in the recharge region. Additionally, the colony buildings and process areas are considered to be located in within the recharge area.

Table 2. Significant potential contaminant sources**.**

Source	Hazard
Inventory Zone	
Corral Area	Animal Wastes
Garden/Cropped Agricultural Land	Land Application of Animal Waste Spills and Excess Application of Herbicides
Former Duck Pond Area	Animal Wastes
Recharge Area	
Barns	Leaking Sewer Lines or Collection System
Slaughterhouse	Leaching from Animal Wastes
Housing	Leaking Sewer Lines
Fuel/Chemical Storage	Spills
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 New Rockport 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 New Rockport Colony.

CHAPTER 4
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 New Rockport 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 that could be pursued by the New Rockport Colony PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the New Rockport Colony PWS wells (Table 3). Hazard is rated by the proximity of a potential contaminant source to the well(s). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 4).

Table 3. Relative susceptibility to specific contaminant sources based on hazard and barriers.

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

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 inventory 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 inventory 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 inventory zone.

When the location of septic systems are known, they are treated as point sources, with hazards assigned based on the above criteria. For non-point sources, the relative hazard is assigned the same for both confined and unconfined aquifers. For residential areas with multiple septic systems with only estimated locations and thus

an estimated density, they are treated as non-point sources with hazards assessed following non-point source criteria. For non-point sources, primary hazard levels are assigned based on the relative concentration of the sources within the inventory zone, based on the following 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

There is no well construction information available for the PWS well. Since the well was constructed prior to the establishment of construction criteria for PWS wells, the well is assumed to not have a full seal through the confining layer. As a result, the several sites identified as potential contaminant sources located within the inventory zone are assigned a relative hazard of high, while the remaining colony buildings and facilities at given a relative hazard of moderate.

There are several barriers for the PWS well. A barrier that is present for all potential contaminant sources is clay-rich soils at the surface. As a barrier to help protect the PWS wellhead from surface water infiltration, a french drain system was installed in 1995. The french drain is considered as an engineered barrier. Finally, a management plan was prepared for land application of animal wastes, downgradient from the PWS well. This represents an effective management barrier for disposal of these wastes. In addition, since the use of chemicals in the colony is limited, an additional barrier of using best management practices (BMPs) for chemical use is assigned.

The results of the susceptibility assessment are summarized in Table 4, with recommended management actions. The results indicate that multiple barriers are present to mitigate the effects of any potential contamination from the buildings and activities of the colony. The location of the well away from the central part of the colony provides a measure of protection to potential impacts to water quality in the wells.

Table 4. Susceptibility assessment of significant potential contaminant sources**.**

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Inventory Zone						
Corral Area	Pathogens and Nitrate	Infiltration and runoff	High	Low Permeability Soils; French Drain	Moderate	Management of wastes
Garden/Cropped Agricultural Land	SOCs/Nitrates	Leaching and Runoff	High	Low Permeability Soils; BMPs for handling	Moderate	Apply According to Label Instructions
Former Duck Pond Area	Pathogens and Nitrate	Leaching and Runoff	High	Low Permeability Soils; French Drain	Moderate	Dispose of Wastes Outside Inventory Region
Recharge Area						
Barns	Pathogens and Nitrate	Infiltration and Runoff	Moderate	Low Permeability Soils, Land Application Plan for Waste	Low	Dispose of Waste Outside Inventory Region
Slaughterhouse	Pathogens and Nitrate	Infiltration and Runoff	Moderate	Low Permeability Soils, Land Application Plan for Waste	Low	Dispose of Waste Outside Inventory Region
Housing	Pathogens and Nitrate	Leakage from sewage lines	Moderate	Low Permeability Soils	Moderate	Monitor integrity of sewer lines
Fuel/Chemical Storage	VOCs, SOCs	Spills	Moderate	Low Permeability Soils, BMPs for Handling	Low	Recycle / Dispose of Waste Chemicals Properly
County Roads	VOCs, Pathogens and Nitrate	Spills	Moderate	Low Permeabiity Soils	Moderate	Develop emergency response plan
Colonywide	VOCs, SOCs	Spills	Moderate	Low Permeability Soils, BMPs for handling	Low	Recycle / Dispose of Waste Chemicals Properly
Cropped Agricultural Land	SOCs, Nitrates	Infiltration and Runoff	Moderate	Low Permeability Soils	Moderate	Communicate with upgradient landowner, apply chemicals according to label instructions

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GLOSSARY*

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

Alkalinity. The capacity of water to neutralize acids.

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

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

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

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

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

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

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

Community. A town, neighborhood or area where people live and prosper.

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

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

Confining Unit. A geologic formation present above a confined aquifer that does not allow the flow of water, maintaining the pressure of the ground water in the aquifer. The physical properties of a confining unit may range from a five-feet thick clay layer to a shale that is hundreds of feet thick.

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

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

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

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

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

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

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

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

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

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

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

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

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

Montana Pollutant Discharge Elimination System (MPDES). Database system to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national database system to track entities that discharge wastewater.

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

Nonpoint-Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of chemicals into surface and/or ground waters at increased levels that may exceed MCLs.

Pathogens. A microorganism 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.

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

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

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

Recharge Region. A source water management region that is generally the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner. The Resource Conservation and Recovery Information System (RCRIS) provides information about specific sites through the EPA Envirofacts website.

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

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

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

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

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

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

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

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

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

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

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

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

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

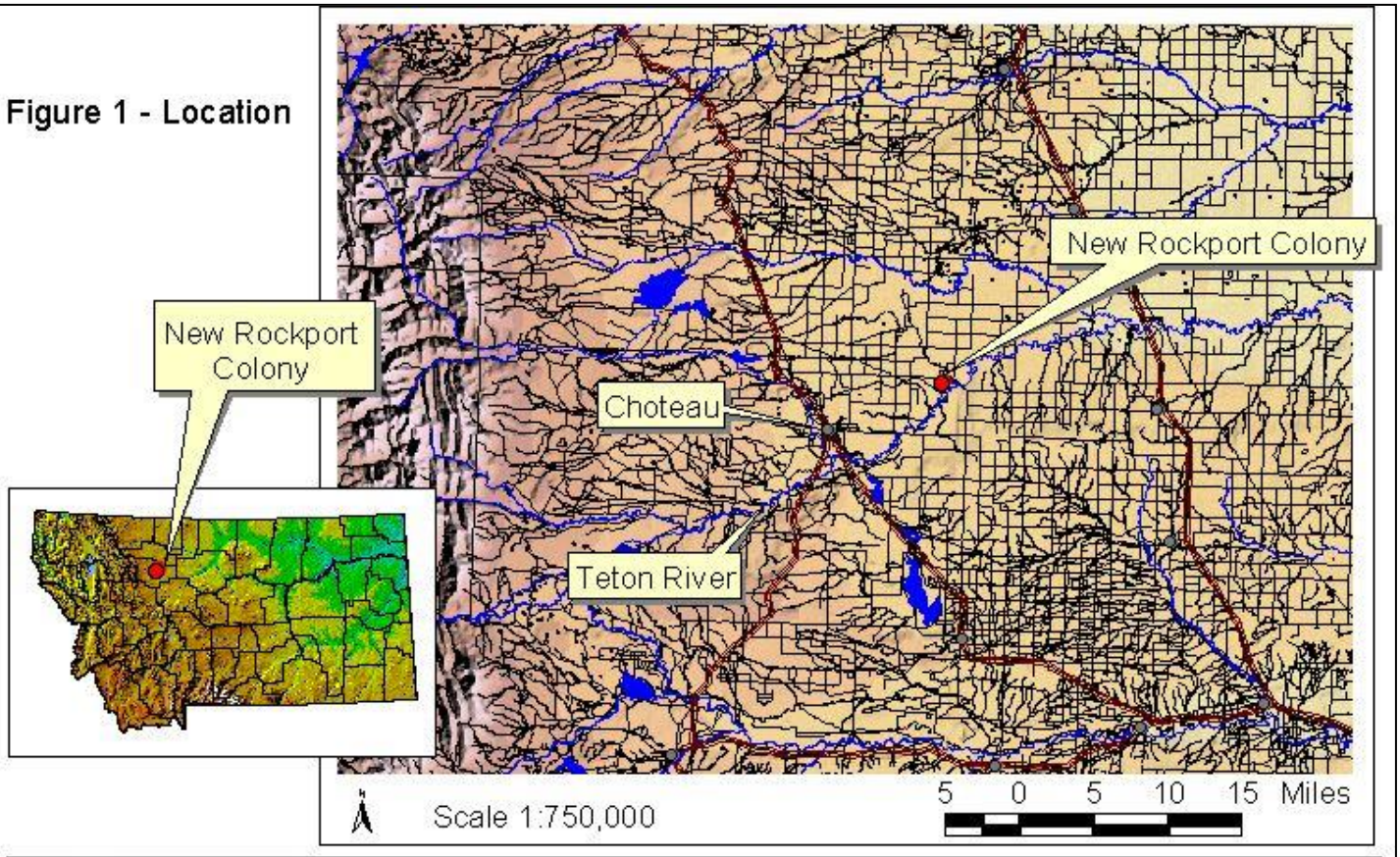
Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.

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

* Definitions adapted from EPA's Glossary of Selected Terms and Abbreviations (http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html)

Figures

Figure 1 - Location



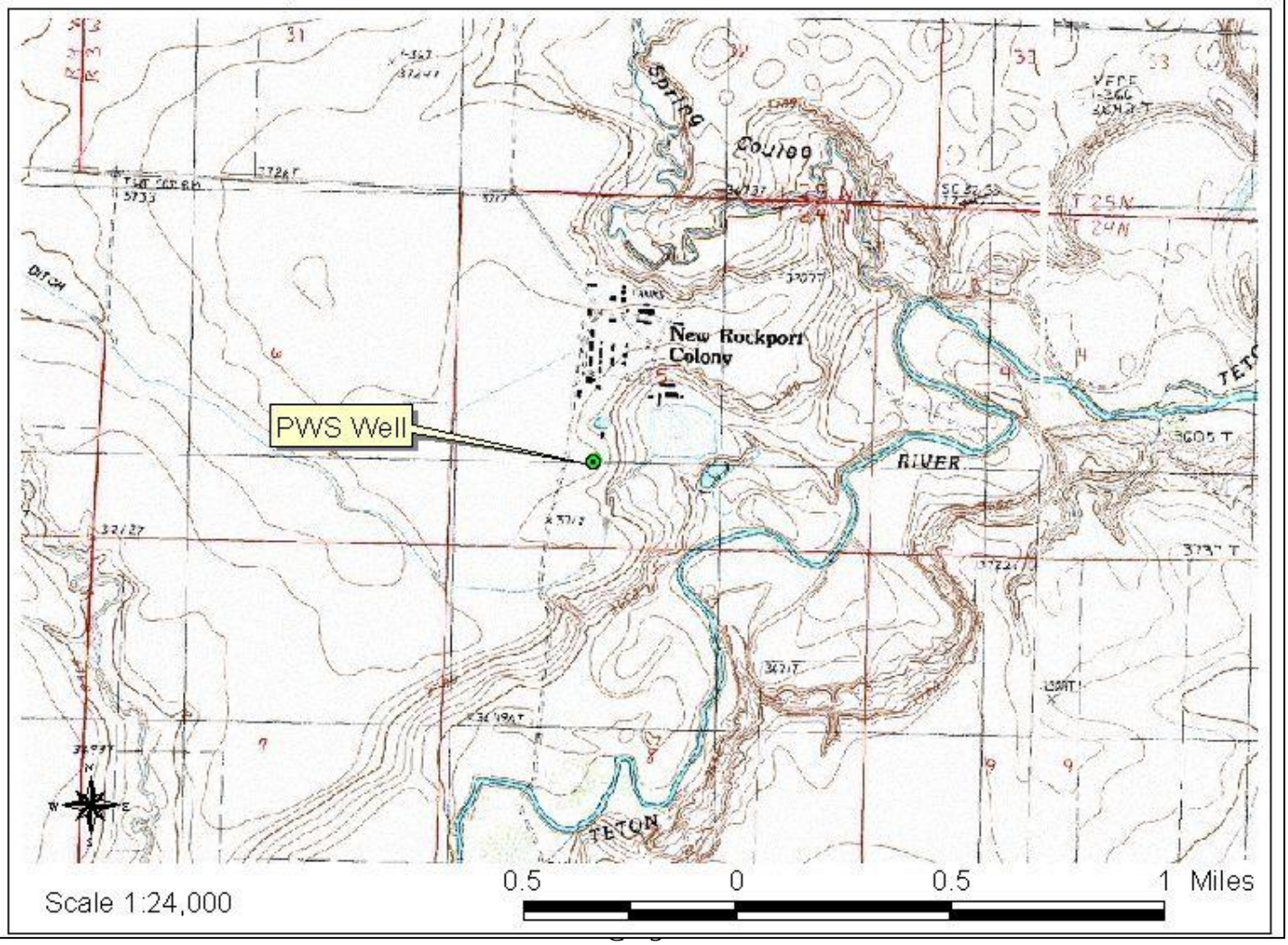


Figure 2 - Geologic Map

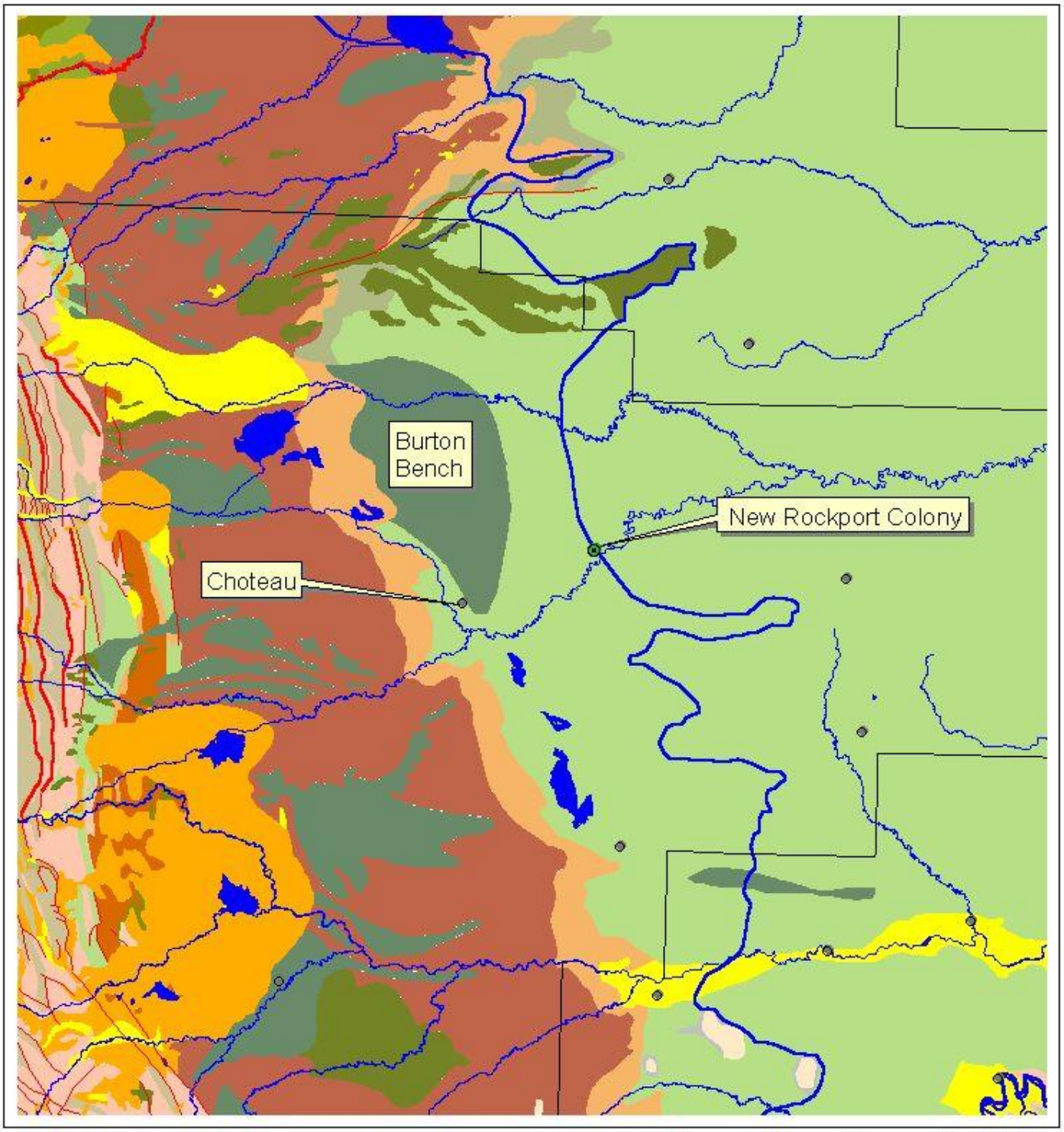


Figure 3 - Surface Features of Burton Bench and Surrounding Area

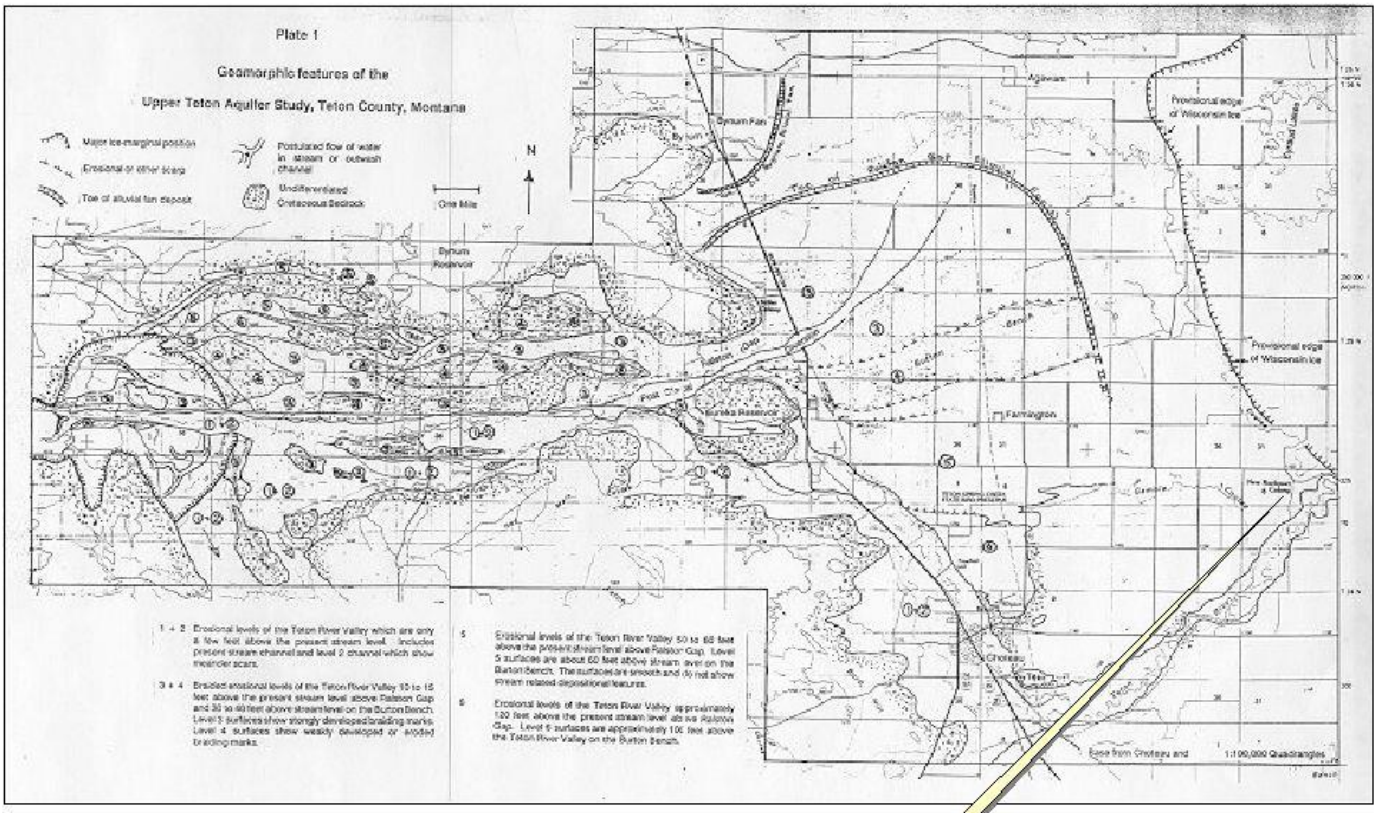


Plate 1, Patton (1991)

Figure 5 - Inventory Zone

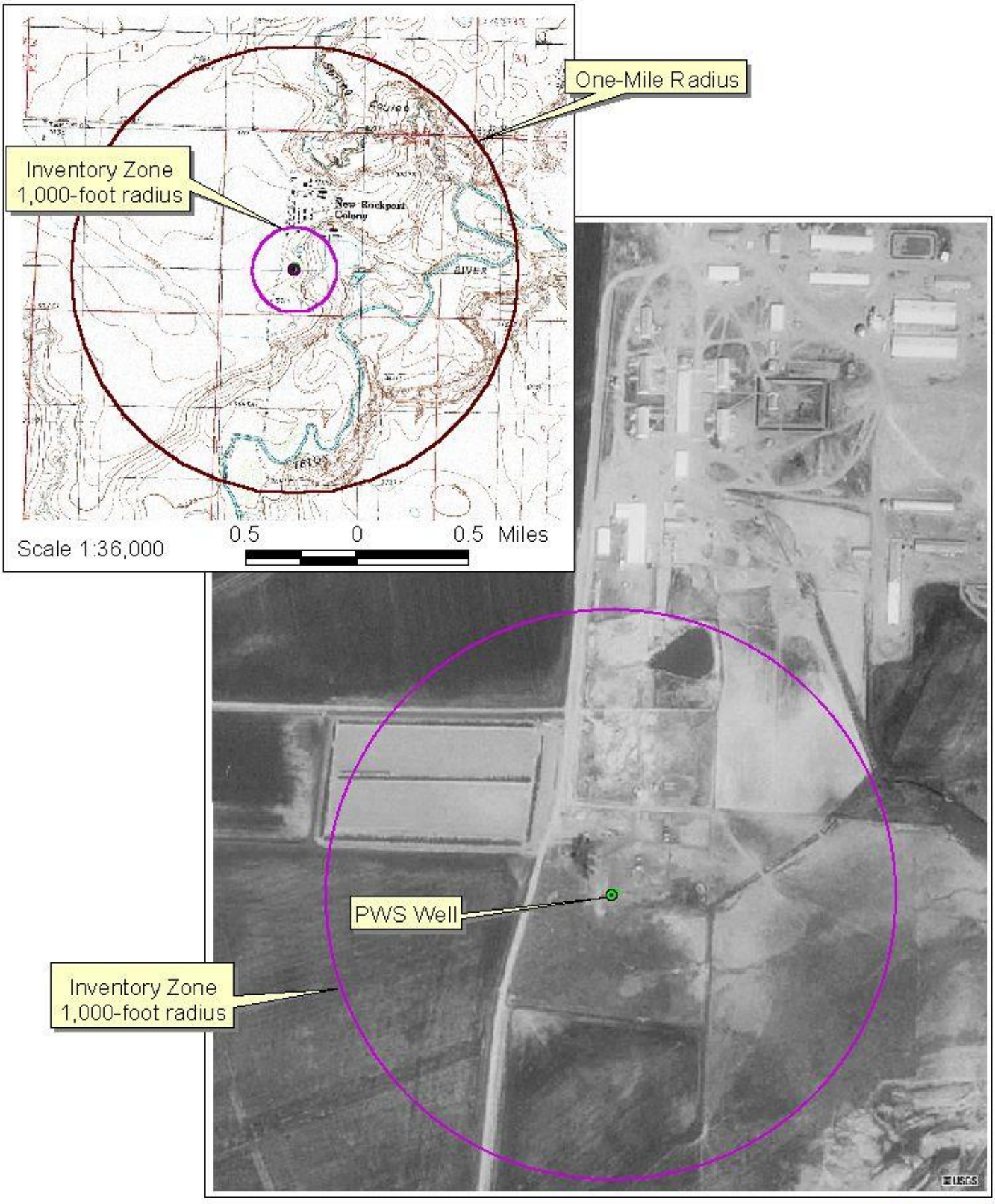
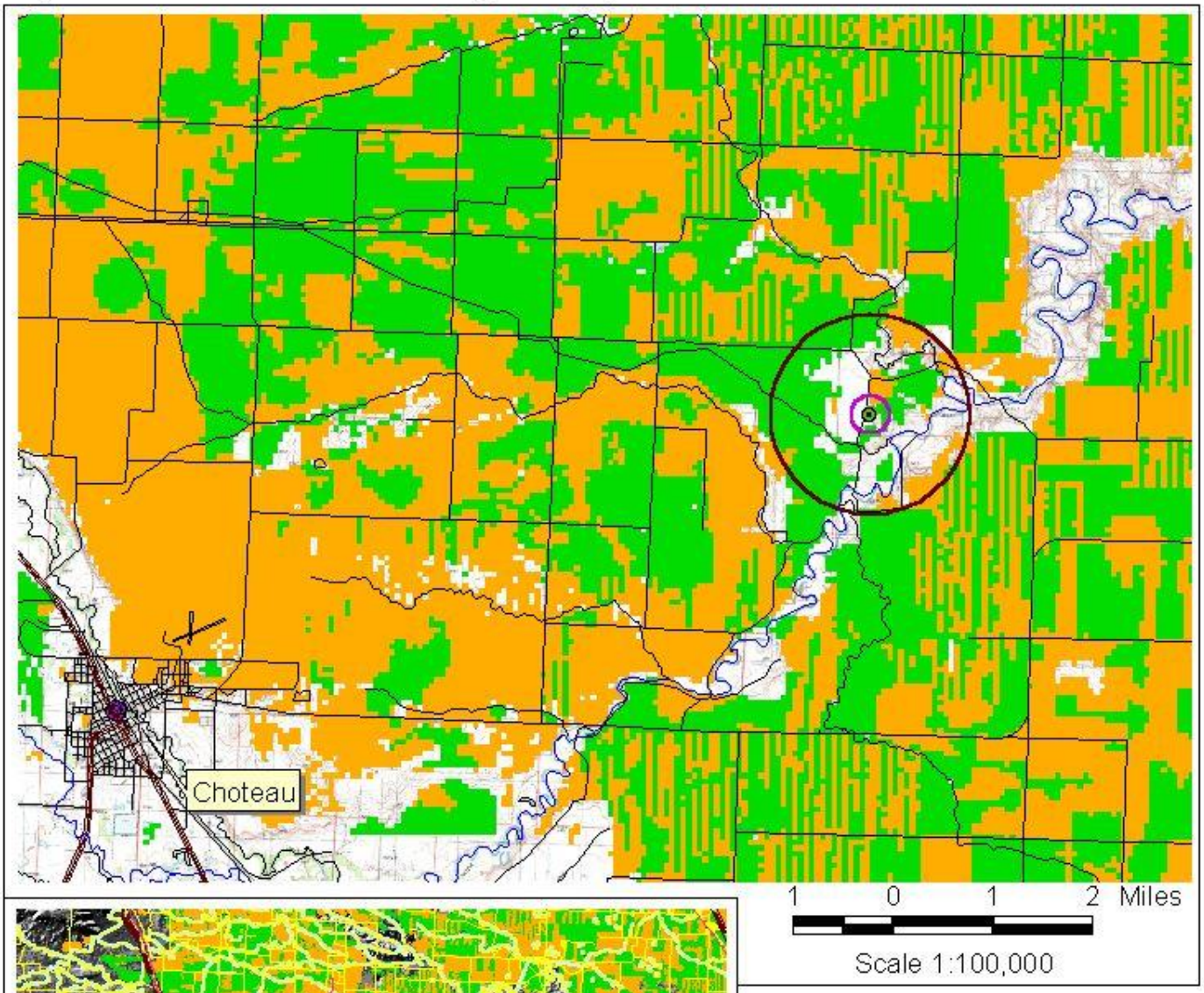
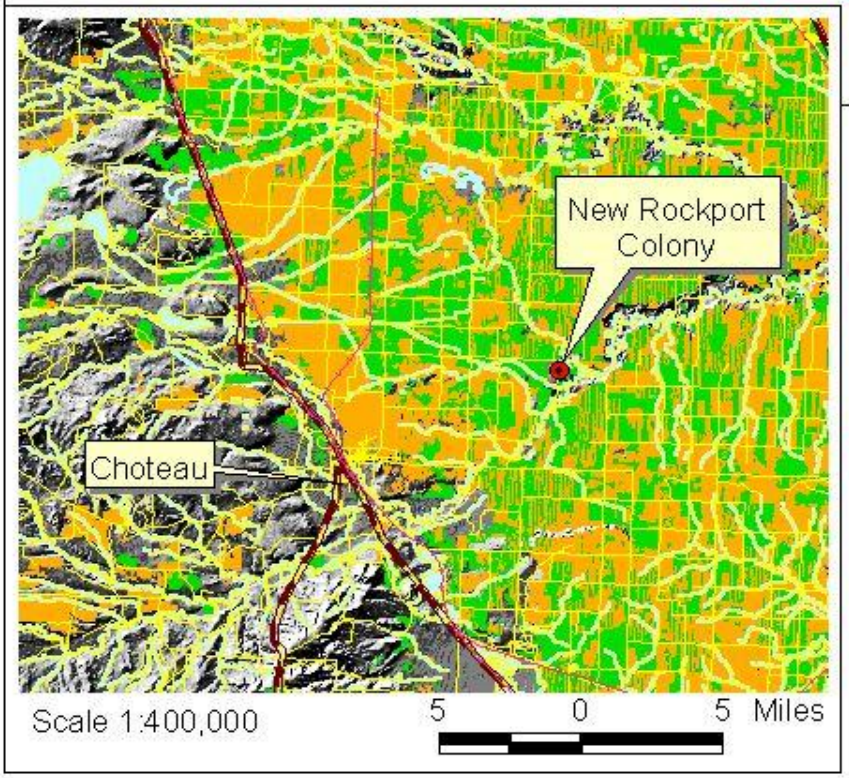


Figure 6 - Area Land Use and Major Transportion Routes





Explanation

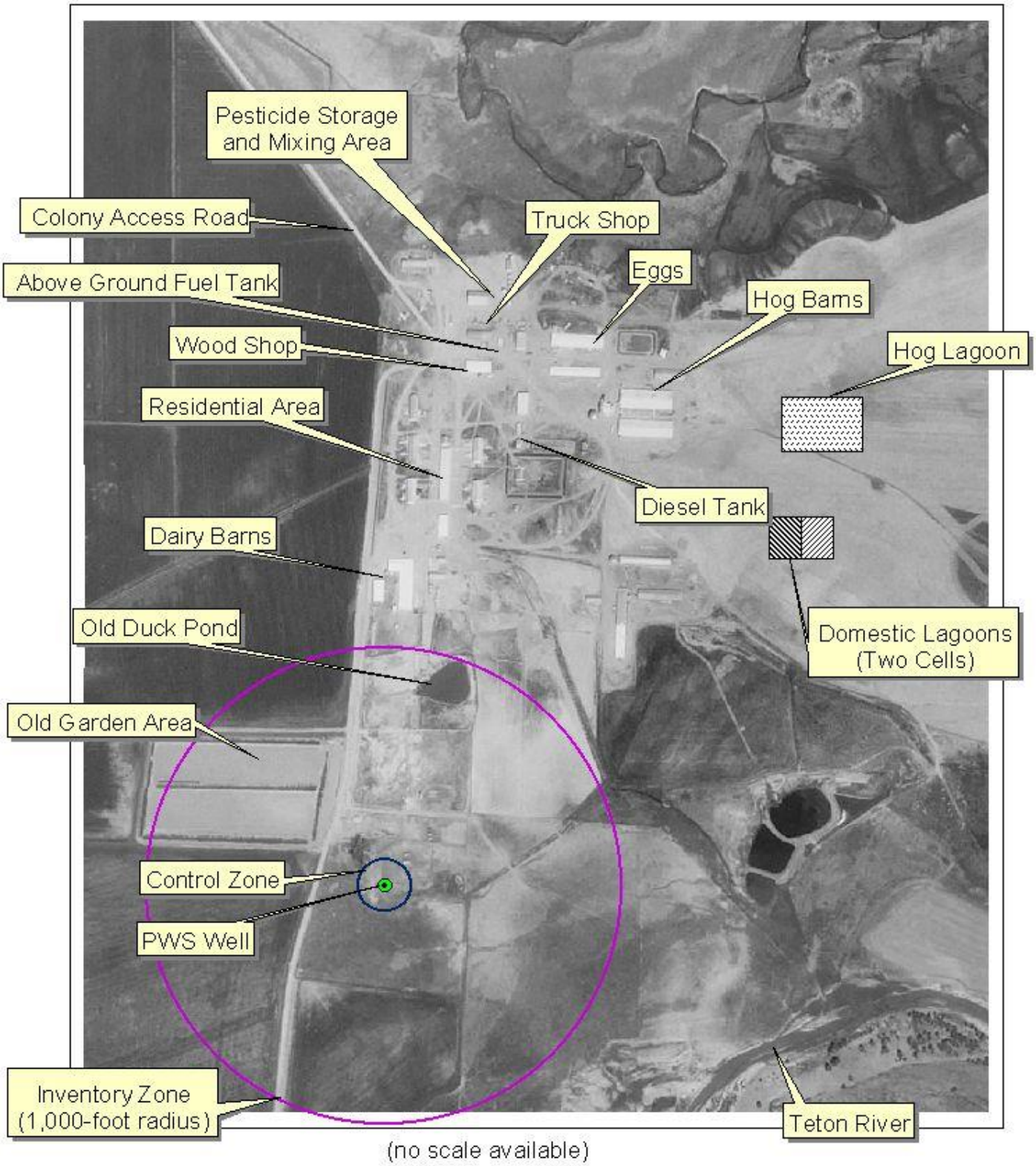
- New Rockport Colony PWS Well
- One-Mile Radius Around PWS Well
- Well Inventory Zone - 1,000 foot radius

Agricultural Land Use

- Dry Agriculture
- Irrigated Agriculture

Land Use Adapted from Montana GAP Analysis, Redmond et. al., 1999

Figure 7 - New Rockport Colony Inventory



(no scale available)

Estimates of Ground Water Flow Rates

Methods and Criteria

The source water protection areas were delineated using the uniform flow equation. The lack of any specific data on hydrologic characteristics of the area limits the accuracy of the calculated estimates of hydrologic flow rates. The use of the uniform flow equation assumes that flow within the sandstone is uniform through primary porosity, and that the fracture system enhancing effective porosity is uniform through the aquifer. To address the uncertainties in the flow system, all estimated property values reflect conservative assumptions to ensure that proper management zones reflect all potential contaminant sources that may impact the New Rockport Colony water supply.

Model Input

The hydrologic parameter values used for the flow rate calculations are summarized in Table 3 and described in the following, with the criteria for selection of each value:

- ***Thickness***: The thickness of the aquifer for the water source was estimated as 20 feet.
- ***Hydraulic Conductivity***: The hydraulic conductivity was estimated using a literature value of 250 feet per day (Heath, 1989), which is a value typical for glacial gravel deposits.
- ***Hydraulic Gradient***: The hydraulic gradient was estimated as the general gradient of surface topography in the area, estimated at 50 feet/mile, or 0.01 feet/feet.
- ***Porosity***: The value for effective porosity is estimated from Heath (1989) at 30%.
- ***Pumping Rate***: The pumping rate was estimated at 32 gpm, based on estimated well use.

Results

Ground water flow in the PWS aquifer, based on the above assumptions, travels an estimated distance of 3,150 feet (0.6 miles) in a one-year period. The three year time of travel distance is estimated at 9,250 feet (1.75 miles).

New Rockport Public Water Supply
Summary of Time of Travel Calculations

Property		**Units**	
porosity	n	percent	0.3
Hyd Cond	K	ft/day	250
Hyd Grad	I	ft/ft	0.01
Pumping Rate	Q	gpm	32
		ft3/day	6160
Aquifer Thickness	b	feet	20
Distance Upgradient to Null Point			
Null Distance	Xl	feet	20
		miles	0.00
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	62
		miles	0.01

Time of Travel Calculations

Distance Traveled		**Time of Travel**	
feet	miles	days	years
1000	0.19	110.70	0.30
100	0.02	7.75	0.02
500	0.09	52.29	0.14
1000	0.19	110.70	0.30
2500	0.47	288.57	0.79
5000	0.95	586.95	1.61
5280	1.00	620.42	1.70
7500	1.42	886.00	2.43
10000	1.89	1185.33	3.25
10560	2.00	1252.40	3.43
15000	2.84	1784.37	4.89
15840	3.00	1885.05	5.16
19100	3.62	2275.81	6.23
21120	4.00	2517.97	6.89
25000	4.73	2983.17	8.17
31680	6.00	3784.22	10.36
40000	7.58	4782.07	13.09
3150	0.60	366.03	1.00
9250	1.75	1095.51	3.00
15350	2.91	1826.32	5.00