Katoonah Lodges
Public Water System

PWSID # MT0003692

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Date of Report: 03/04/04

Jeff McCleary,
Certified Operator

10624 Oral Zumwalt Way, Missoula, MT 59803

phone: ***273-3197***

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ACKNOWLEDGMENTS

This Delineation and Assessment Report was completed by Jeff McCleary for:

- *Katoonah Lodges, Missoula County*
- *PWSID# 03692*
- *John Stahl 5903 Mullan Rd, Missoula, MT 59802*

INTRODUCTION

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for Katoonah Lodges as required by the Montana Source Water Protection Program and the federal Safe Drinking Water Act (SDWA).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for Katoonah Lodges.

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 locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of source water protection plans, the mechanism Katoonah Lodges can use to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Katoonah Lodges operator and the community to complete a source water protection plan that meets their specific needs.

CHAPTER 1
BACKGROUND

The Community

Katoonah Lodges is a mobile home park designed to serve persons of 55 years and older. The system serves approximately 155 persons through 103 service connections.

Wastewater from the system is currently handled by a septic tank and drain field system. However, the system will be connected to the Missoula City Sewer System by the end of 2004.

Katoonah Lodges is located north and west of Missoula on the north side of Mullan Road approximately 2 miles west of North Reserve Street.

Geographic setting

Katoonah Lodges is located in the Missoula Valley 2 miles west of Missoula, MT and approximately 1 mile north of the Clark Fork River. (See Vicinity Map Appendix A)

The local climate is semi-arid. The 1959-1988 annual precipitation average is 13.74 inches per year. February and March are typically the driest months and June the wettest. The 30-year average temperature is 44.6^{o}F. January is usually the coldest month and July is usually the warmest. (National Weather Service, 1989).

General description of the Source Water

Katoonah Lodges Well # 1 and Well # 2 are drilled to a depth of 138.5' and 139 feet respectively. At the time of drilling, each well had a static water level of 25 feet and a pumping water level of 28 feet. Each well is drilled through a 48-foot clay layer. (See Katoonah Lodges Area Wells, Appendix I1 and I2) Well logs from wells of similar depth in the area seem to indicate that the layer continues to the south at least 1000 feet. While it is difficult track due to the vagaries of well log lithologies, the clay layer appears to persist at least a half mile to the north of the Katoonah Lodges PWS wells. (See area well logs in Appendix C)

For the purposes of this report the Katoonah Lodges wells are considered to be confined. Ground water in the area generally flows east to west following the contours of the Missoula Valley with recharge taking place in the hills to the north.

The Public Water Supply

The Katoonah Lodges serves approximately 155 persons through 103 service connections.
The system is served by 2 ground water wells. The wells are located approximately 60 feet apart

Well # 1 is drilled to a depth of 138.80 feet with an 8 inch slotted casing. The slots are from 118' to 138' feet. The well is equipped with a 15 HP Fairbanks Morse submersible pump. The well log indicates that this well test pumped at 565 gpm in an 8-hour test. The static water level at the time of completion was 25 feet and the pumping water level was 28 feet.

Well # 2 is drilled to a depth of 139 feet with an 8 inch slotted casing. The slots are from 118' to 138' feet. The well is equipped with a 15 HP Fairbanks Morse submersible pump. The well log indicates that this well test pumped at 565 gpm in an 8-hour test. The static water level at the time of completion was 25 feet and the pumping water level was 28 feet.

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Water is pumped from the wells to a common header located inside the pump house. A 2,500 gallon pressurized tank provides storage and pressurizes the system. (See Appendix B1 Pump House Photo and B2 Site Plan). Kick on pressure for the system is 40 psi and kick off pressure is 60 psi. Peak summer time use for the system is approximately 97,747 gpd. Wintertime use is a more modest 27,398 gpd.

The system is not currently required to treat its water.

Water Quality

Every public water supply is required to sample for various parameters to monitor for potential contamination and water quality parameters which may impact the quality of the water provided to the system's users. As a community water system, Katoonah Lodges is required to sample for Phase II and V IOCs, SOCs and VOCs, Lead and Copper, Nitrate and Radionuclides. Bacteriological samples are required monthly. No VOCs, SOCs have been detected. The system has detected Gross Alpha at 1.1 pCi/L, combined Radium 226 and 228 at 1.40 pCi/L and radium 226 at 1.4 pCi/L. These levels do not exceed the maximum contaminant levels. Nitrate levels average around 1.32 mg/L.

The system has no history of coliform positive samples.

The following table shows some of the representative IOCs (Inorganic Constituents) which occur in the aquifer.

Year	*Antimony*	*Arsenic*	*Barium*	*Beryllium*	*Cadmium*	*Chromium*	*Fluoride*	*Mercury*	*Nickel*	*Nitrate*	*Selenium*
2000	-	-	-	-	-	-	-	-	-	*1.62 mg/L*	-
2001	*0 mg/L*	*0 mg/L*	*.39 mg/L*	*0 mg/L*	*0 mg/L*	*0 mg/L*	*0.09 mg/L*	*0 mg/L*	*0 mg/L*	*1.07 mg/L*	*0 mg/L*
2002	-	-	-	-	-	-	-	-	-	*1.26 mg/L*	-
2003	*0 mg/L*	*0 mg/L*	*0.4 mg/L*	*0 mg/L*	*0 mg/L*	*0 mg/L*	*0.2 mg/L*	*0 mg/L*	*0 mg/L*	*1.33 mg/l*	*0 mg/L*

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to *Katoonah Lodges*, 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 represents the zone of contribution of the well, which approximates a three-year groundwater time-of-travel. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The recharge region represents the entire portion of the aquifer which contributes water to *the Katoonah Lodges* water system.

Hydrogeologic Conditions

Katoonah Lodges wells are drilled into Quatenary Alluvial deposits of the Missoula Valley (Qat and Qal, see Appendix C, Geologic Map). Hydrological studies indicate that Quaternary sediments form the primary aquifer in the Missoula Valley. The surface geology of the area consists of a confining layer of tan to reddish pink clay that settled out of Glacial Lake Missoula. Katoonah Lodges well log lithologies reflect this as they show a confining clay layer 48 feet thick. Eastward, well logs indicate a more of a sand and gravel alluvium, with little indication of a confining clay layer.

Well depths in the area range from 15 feet to 205 feet. Most of the wells are finished at around the 100-foot depth in sand and gravel alluvial material.

Ground water flow is generally east to west, with local recharge from the Butler Creek and Grant Creek drainages to the north. Source water sensitivity is moderate

Table 1. List of geologic or hydrogeologic investigations near the Katoonah Lodges area.

Title of Project	Period of Project	Area Covered	Project Purpose
Preliminary Geologic Map of the Montana Part of the Missoula West 30' X 60' Quadrangle	1998	Missoula West 30'X 60” Quadrangle	To provide digital geologic map coverage for the Missoula West 30' X 60' quadrangle
Draft PWS 6 Report for Phantom Hills Public Water Supply	01/24/03	Approximately 3 miles west of Missoula	PWS 6 Report for Public Water Supply
The Hydrogeology of the Central and Northwestern Missoula Valley	June, 1992	Central and Northwestern Missoula Valley	Masters Thesis

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. For the Katoonah Lodges area, ground water comes from the Missoula Valley aquifer whose source is discharge from the Clark Fork River, infiltration of precipitation and stream losses to groundwater, and inflow from the surrounding bedrock where the foothills meet the valley margins.

Ground water flow generally follows the contours of the Missoula Valley in a predominantly east to west flow pattern. Recharge occurs from the mountains to the north and more locally in the Butler Creek/Grant Creek

drainages. Seasonal fluctuations in water volume probably have little impact on flow direction in this situation since this system is drawing from a confined aquifer.

Both wells demonstrate confined characteristics (both rise well into the bore above the water-bearing zone, both have significant clay layers over the water-bearing zone). Therefore, it is assumed for the purposes of this report that both wells are part of the same local aquifer system and confined.

Methods and Criteria

The methods and criteria used to delineate source water protection zones for the Katoonah Lodges public water supply are specified in the Montana Department of Environmental Quality Source Water Protection Program (DEQ, 1999). For the Katoonah Lodges public water supply, criteria for wells finished in a confined aquifer were followed and a one-thousand foot radius inventory area has been delineated.

Well(s) Information

See Well Logs, Appendix I.

Table 3. Source well information for Katoonah Lodges.

Information	Well #1	Well #2
PWS Source Code	WL002	WL003
Well Location (T, R, Sec or lat, long)	Lat 46.8864 Long -114.0797	Lat 46.8864 Long -114.0797
MBMG #	134807	134806
Water Right #	NA	NA
Date Well was Completed	04/26/93	04/23/93
Total Depth	138.80 feet	139.0 feet
Perforated Interval	118 feet to 138 feet	118 feet to 138 feet
Static Water Level	25 feet	25 feet
Pumping Water Level	28 feet	28 feet
Drawdown	3 feet	3 feet
Test Pumping Rate	565 gpm	565 gpm
Specific Capacity	188.3 gpm/ft	188.3 gpm/ft

Delineation Results

A 100-foot radius around each well has been delineated as the Control Zones.

A 1000-foot radius around each well has been delineated as the Inventory Zones due to the confined nature of the Katoonah Lodges wells.

The Recharge Area extends to the top of the mountains to the north and to the top of the hills to the east of the system as indicated on the Base Map (See Appendix F, Base Maps).

Limiting Factors

This delineation is based on estimated aquifer properties, pumping conditions and groundwater flow conditions. Conclusions based on this interpretation are uncertain because the extent and properties of the aquifer, and the direction and rate of groundwater flow are not known precisely.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for *Katoonah Lodges* 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 *Katoonah Lodges* inventory region are *nitrate, pathogens, fuels, herbicides.*

The inventory for *Katoonah Lodges* focuses on all activities in the control zone, municipal and private facilities in the inventory region, and general land uses and large facilities in the recharge region.

Inventory Method

A "windshield survey" was conducted for this assessment.

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

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

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts (http://www.epa.gov/enviro/) to identify Concentrated Animal Feeding Operations with MPDES permits. The water system operator or other local official familiar with the area included in the inventory region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the inventory region: Underground Storage Tanks (UST) (http://webdev.deq.state.mt.us/UST/), hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau), landfills (http://nris.state.mt.us/gis/datalist.html), abandoned mines (http://nris.state.mt.us/gis/datalist.html) and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: A business phone directory was queried to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by SIC code.

Step 6: Major road and rail transportation routes were identified throughout the inventory region (http://nris.state.mt.us/gis/datalist.html).

Step 7. All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region and identified on the base map.

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

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

Inventory Results/Control Zone

The control zone represents the most critical point to protecting the integrity of the wellhead for ground water sources.

The land within the Control Zone for well #1 (Source WL002) is residential land use and is owned by the owner of the court. The pump house for the system is located within the Control Zone. Sewer mains leading to the drain field are located within the Control Zone. Access roads for the court and paved parking areas for a couple of the mobile homes also fall within this Control Zone. (See Inventory Map, Appendix H).

The land within the Control Zone for well #2 (Source WL003) is residential land use and owned by the owner of the court. The pump house for the system is located within the Control Zone. A septic tank is located on the west side of the Control Zone, approximately 60 feet from the well, as well as portion of the septic line which leads to the drain field. Access roads for the court and paved parking areas for a couple of the mobile homes also fall within the Control Zone. (See Inventory Map, Appendix H).

As noted previously in this report, Katoonah Lodges will be connected to the city of Missoula wastewater system by years end.

Inventory Results/Inventory Region

Land use within the Inventory Area is predominantly residential. Wastewater produced by Katoonah Lodges is treated by a large capacity septic system with drain fields located at the north end of the system and the southeast side of the system. Septic tank density for the Katoonah Lodges area is consider moderate, with less than 300 septic systems per square mile. Recently, the sewer line of the Missoula Wastewater system was extended past Katoonah Lodges. The owner intends to connect his septic system to this in the future, thus eliminating the use of his drain fields.

Many homeowners in the court have their lawns commercially treated. Trupower, Tripower and some Roundup are trade names of the chemicals used for weed control. A mixture of nitrogen, potassium and phosphorus are used for fertilizer. Chemical applicators are licensed by the State of Montana.

Many maps show a railroad track running northwest to southeast on the northeastern side of the court. This track has been out of use for several years. Hiawatha Road presently follows the old railroad bed.

The main transportation route through the area is Mullan Road. Other transportation routes in the Inventory Area are the court's access roads, namely, Josephine, Pelky, Dukes, Meininger and LeBeau. An accident on any of these routes could result in a spill of petroleum products. (See Inventory Map, Appendix H)

A few of acres (< 20% of the inventory area) of agricultural ground are located to the south of the system. This is owned by the court owner and is used to grow hay. Fertilizer (16-20-0) is applied to these fields approximately every 4 years. No herbicides or pesticides are applied to these fields.

Table 5. Significant potential contaminant sources for Katoonah Lodges.

Source	Contaminants	Description
Large Capacity Septic System at Katoonah Lodges	*Pathogens and Nitrates*	*Septic tank located approximately 60 feet from Well #2. Septic lines leading to drain fields* within Control Zone & throughout the court.
Transportation Routes	*Spills*	*Potential for spilled fuel due to vehicle accidents*
Lawn Care	Herbicides and Nitrates	Trupower, Tripower, Roundup for herbicides. Nitrogen, Potassium and Phosphorus for fertilizer.
Irrigated Crop	Fertilizer	16-20-0 fertilizer, leaching to ground water

Inventory Results/Recharge Region

The Recharge Region includes forest, grazing, and industrial lands. No specific significant potential contaminants were identified in this area.

Inventory Update (necessary for SWP plan certification purposes only)

The certified operator will update the inventory every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

Since not every residence in the Inventory/Recharge region could be investigated, there remains the possibility that some potential contaminant sources could be unaccounted for. No large volume producers of known contaminants were found or indicated in the investigation. In a rural/residential setting such as this it is likely that some herbicides might be used, as well as some over-the-counter pesticides. However, no use of any significant volume of either of these was indicated by the inventory. No mixing or loading areas for herbicides or pesticides were located.

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 *Katoonah Lodges*.

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 *Katoonah Lodges* 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 Katoonah Lodges well(s) (Table 5). 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 6). The susceptibility of each well to each potential contaminant source is assessed separately.

Table 6. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

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

Table 7. Susceptibility assessment for significant potential contaminant sources in the Control Zone and Inventory Region**.**

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Large Capacity Septic System @ Katoonah Lodges	**Pathogens & Nitrates**	**Infiltration & Recharge**	**Very High**	**2 Barriers (Pressure Dosing System and Septic Systems located laterally to the north and east of PWS wells)**	**Moderate**	**Monitoring**
Transportation Routes	**Spills**	**Infiltration & Recharge**	**High**	**3 Barriers (Lateral to PWS wells & Spill Response & Surface Drainage)**	**Moderate**	**Monitoring**
Irrigated Cropland	**Fertilizer**	**Infiltration & Recharge**	**Low (< 20%)**	**2 Barriers (Down gradient of PWS wells & Surface Drainage**	**Low**	**Monitoring**
Lawn Care	**Herbicides & Nitrates**	**Infiltration & Recharge**	**Not rated**	**Not rated**	**Not rated**	**Monitoring**

The following items are the significant potential contaminants found in the inventory/recharge area of the Katoonah Lodges PWS. Susceptibility of contamination for these potential contaminants has been ranked quite conservatively and should not be used to make any regulatory decisions regarding the Katoonah Lodges public water supply without a more enhanced assessment. While the system currently monitors for contaminants, which may result from these potential contaminant sources, monitoring only identifies the problem after the fact and does nothing towards preventing it.

The number of septic systems in the Katoonah Lodges inventory area is estimated to be greater than 300 and per square mile. This ratio is considered to indicate a High hazard to the public water supply. These septic systems are pressure-dosing systems and are located laterally to the PWS wells. These factors should be considered as 2 barriers to contamination. Therefore, while the septic systems are considered very high hazard, susceptibility is ranked as moderate low.

The transportation routes and railroad right-of-ways passing through the Katoonah Lodges Inventory provide potential for fuel or other spills in the event of a vehicle wreck. Mullan Road is topographically located downhill from the PWS wells. That provides a physical barrier to contamination. It is also lateral to the PWS wells. Missoula HazMat team response to a spill in the area can be expected within approximately one hour. This type of response should be considered a third barrier to potential contamination. Therefore, spills along transportation routes are a very high hazard, but with three barriers in place susceptibility should be considered moderate.

Less than 20% of the land in the inventory area is irrigated cropland. A mixture of 16-20-0 fertilizer is applied by the owner approximately once every 4 years. The fact that this cropland is down gradient from the PWS wells and surface drainage is away from the PWS wells should be considered as two barriers to anything that may be applied to these fields. Therefore, the hazard is low and susceptibility to contamination should be considered moderate.

Potential contamination from lawn care applications present a very high hazard. Testing for contamination from these products make up a significant part of a public water supply's monitoring burden. It is very difficult to determine the amounts of frequency of lawn care products used in the inventory area, so a rating on this parameter was not attempted.

Waivers

Based on the information presented in this assessment, the Katoonah Lodges public water supply requests that the system be considered for waivers from monitoring the following currently required EPA analysis methods: EPA Method 525.2 (Semivolatile Organic Chemicals) and EPA Method 531.1 (Carbamate Pesticides). At this time, the system does not request to be considered for waivers from monitoring EPA Method 524.2 (VOCs) or EPA Method 515.1 (Herbicides).

REFERENCES

Preliminary Geologic Map of the Montana Part of the Missoula West 30' X 60' Quadrangle Lewis, Reed S. 1998 MBMG Open File Report 373

The Hydrogeology of the Central and Northwestern Missoula Valley
Smith, Clifford A. Presented in Partial Fullfillmentof the Requirements for the Degree of Master of Science, University of Montana 22 April, 1992

Draft PWS 6 Report for Phantom Hills Public Water Supply, Missoula County, MT January 24, 2003 by WGM Group, Missoula, MT

APPENDICES

Appendix A

Appendix B

Appendix C

Montana Bureau of Mines and Geology [Plot this site on a topographic map]
Ground-Water Information Center Site Report
FLYNN MIKE

Location Information

GWIC Id:	*134796*	*Source of Data:*	*LOG*
Location (TRS):	*13N 20W 12 CC*	*Latitude (dd):*	*46.8937*
County (MT):	*MISSOULA*	*Longitude (dd):*	*-114.0786*
DNRC Water Right:		*Geomethod:*	*TRS-SEC*
PWS Id:		*Datum:*	*NAD27*
Block:		*Altitude (feet):*	
Lot:		*Certificate of Survey:*	
Addition:		*Type of Site:*	*WELL*

Well Construction and Performance Data

Total Depth (ft):	*99.00*	*How Drilled:*	*ROTARY*
Static Water Level (ft):	*27.00*	*Driller's Name:*	*CAMP*
Pumping Water Level (ft):	*50.00*	*Driller License:*	*WWC007*
Yield (gpm):	*100.00*	*Completion Date (m/d/y):*	*5/5/1993*
Test Type:	*AIR*	*Special Conditions:*	
Test Duration:	*1.00*	*Is Well Flowing?:*	
Drill Stem Setting (ft):		*Shut-In Pressure:*	
Recovery Water Level (ft):		*Geology/Aquifer:*	*112ALVM*
Recovery Time (hrs):		*Well/Water Use:*	*DOMESTIC*

Well Notes:

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	*99.0*	*6.0*				*STEEL*

Annular Seal Information

From	To	Description
0.0	*20.0*	*BENTONITE*

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
99.0	*99.0*	*6.0*			*OPEN BOTTOM* *

Lithology Information

From	To	Description
0.0	*8.0*	*CLAY*
8.0	*33.0*	*SAND GRAVEL & CLAY*
33.0	*38.0*	*CLAY & GRAVEL*
38.0	*81.0*	*CLAY*
81.0	*94.0*	*SAND & WATER*
94.0	*99.0*	*SAND GRAVEL & WATER*

Montana Bureau of Mines and Geology *Plot this site on a topographic map*

Ground-Water Information Center Site Report

OLD HELLGATE VILLAGE - WELL 1

Location Information

GWIC Id:	*69604*	*Source of Data:*	*GW2*
Location (TRS):	*13N 20W 14 DADB*	*Latitude (dd):*	*46.8833*
County (MT):	*MISSOULA*	*Longitude (dd):*	*-114.0824*
DNRC Water Right:	*W123877-00*	*Geomethod:*	*NAV-GPS*
PWS Id:	*02635002*	*Datum:*	*NAD27*
Block:		*Altitude (feet):*	*3140.00*
Lot:		*Certificate of Survey:*	
Addition:		*Type of Site:*	*WELL*

Well Construction and Performance Data

Total Depth (ft):	*87.00*	*How Drilled:*	*CHURN*
Static Water Level (ft):	*17.00*	*Driller's Name:*	*CKC*
Pumping Water Level (ft):	*30.00*	*Driller License:*	*WWC185*
Yield (gpm):	*100.00*	*Completion Date (m/d/y):*	*5/2/1972*
Test Type:	*AIR*	*Special Conditions:*	
Test Duration:	*8.00*	*Is Well Flowing?:*	
Drill Stem Setting (ft):		*Shut-In Pressure:*	
Recovery Water Level (ft):		*Geology/Aquifer:*	*120SDMS*
Recovery Time (hrs):		*Well/Water Use:*	*PUBLIC WATER SUPPLY*

Well Notes:

Hole Diameter Information

From	*To*	*Diameter*
0.0	*87.0*	*6.0*

Casing Information[1]

From	*To*	*Dia*	*Wall Thickness*	*Pressure Rating*	*Joint*	*Type*
-1.0	*87.0*	*6.0*				*17 LB STEEL*

Annular Seal Information

No Seal Records currently in GWIC.

Completion Information[1]

From	*To*	*Dia*	*# of Openings*	*Size of Openings*	*Description*
87.0	*87.0*	*6.0*			*OPEN BOTTOM*

Lithology Information

From	*To*	*Description*
0.0	*8.0*	*TOPSOIL*
8.0	*19.0*	*SAND AND GRAVEL*
16.5	*16.5*	*STATIC WATER LEVEL*
19.0	*40.0*	*SAND GRAVEL AND WATER*
40.0	*78.0*	*CLAY*
78.0	*84.0*	*SILTY SAND AND WATER*
84.0	*87.0*	*SAND GRAVEL AND WATER*

Montana Bureau of Mines and Geology *Plot this site on a topographic map*

Ground-Water Information Center Site Report

OLD HELLGATE VILLAGE - WELL 2

Location Information

GWIC Id:	*69666*	*Source of Data:*	*LOG*
Location (TRS):	*13N 20W 14 DADB*	*Latitude (dd):*	*46.8833*
County (MT):	*MISSOULA*	*Longitude (dd):*	*-114.0826*
DNRC Water Right:	*C000598-00*	*Geomethod:*	*NAV-GPS*
PWS Id:	*02635003*	*Datum:*	*NAD27*
Block:		*Altitude (feet):*	*3140.00*
Lot:		*Certificate of Survey:*	
Addition:		*Type of Site:*	*WELL*

Well Construction and Performance Data

Total Depth (ft):	*104.00*	*How Drilled:*	*CABLE*
Static Water Level (ft):	*17.00*	*Driller's Name:*	*CKC*
Pumping Water Level (ft):	*30.00*	*Driller License:*	*WWC185*
Yield (gpm):	*95.00*	*Completion Date (m/d/y):*	*8/10/1973*
Test Type:	*AIR*	*Special Conditions:*	
Test Duration:	*3.00*	*Is Well Flowing?:*	
Drill Stem Setting (ft):		*Shut-In Pressure:*	
Recovery Water Level (ft):		*Geology/Aquifer:*	*120SDMS*
Recovery Time (hrs):		*Well/Water Use:*	*PUBLIC WATER SUPPLY*
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	104.0	6.0

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	104.0	6.0				17 LB STEEL

Annular Seal Information

No Seal Records currently in GWIC.

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
104.0	104.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	6.0	TOPSOIL
6.0	20.0	SAND AND GRAVEL
20.0	41.0	SAND GRAVEL AND WATER
41.0	80.0	CLAY
80.0	87.0	SILT SAND AND WATER
87.0	90.0	SILTY SAND GRAVEL AND WATER
90.0	101.0	CLAY
101.0	104.0	SAND GRAVEL AND WATER

Montana Bureau of Mines and Geology *Plot this site on a topographic map*
Ground-Water Information Center Site Report
LEAN PATRICK

Location Information

GWIC Id:137509
Location (TRS):13N 20W 14 AAB
County (MT):MISSOULA
DNRC Water Right:
PWS Id:
Block:2
Lot:21
Addition:MULLAN TRAIL
Source of Data:LOG
Latitude (dd):46.8914
Longitude (dd):-114.0846
Geomethod:TRS-SEC
Datum:NAD27
Altitude (feet):
Certificate of Survey:
Type of Site:WELL

Well Construction and Performance Data

Total Depth (ft):99.00
Static Water Level (ft):20.00
Pumping Water Level (ft):50.00
Yield (gpm):100.00
Test Type:AIR
Test Duration:1.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:
How Drilled:ROTARY
Driller's Name:CAMP
Driller License:WWC007
Completion Date (m/d/y):9/22/1993
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer:112ALVM
Well/Water Use:DOMESTIC

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	99.0	6.0				STEEL

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
99.0	99.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	10.0	CLAY
10.0	17.0	CLAY- SAND & GRAVEL
17.0	38.0	CLAY- SAND- GRAVEL & WATER
38.0	41.0	CLAY & GRAVEL
41.0	55.0	CLAY
55.0	59.0	SAND & WATER
59.0	70.0	CLAY
70.0	74.0	SAND & WATER
74.0	77.0	CLAY
77.0	95.0	SILT & WATER
95.0	97.0	CLAY & GRAVEL
97.0	99.0	SAND- GRAVEL & WATER

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology *Plot this site on a topographic map*
Ground-Water Information Center Site Report
MAYNARD MARY

Location Information

GWIC Id:149109
Location (TRS):13N 20W 13 BB
County (MT):MISSOULA
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:
Source of Data:LOG
Latitude (dd):46.8905
Longitude (dd):-114.0784
Geomethod:TRS-SEC
Datum:NAD27
Altitude (feet):
Certificate of Survey:
Type of Site:WELL

Well Construction and Performance Data

Total Depth (ft):94.00
Static Water Level (ft):25.00
Pumping Water Level (ft):
Yield (gpm):30.00
Test Type:AIR
Test Duration:1.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
How Drilled:ROTARY
Driller's Name:JEROME
Driller License:WWC249
Completion Date (m/d/y):4/18/1995
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer:112ALVM
Well/Water Use:DOMESTIC
Well Notes:JEROMES FILE NO: 6241

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-2.0	94.0	6.0				STEEL

Annular Seal Information

From	To	Description
0.0	0.0	BENTONITE

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
94.0	94.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	2.0	SOIL
2.0	14.0	SILTY SAND
14.0	25.0	SAND-GRAVEL
25.0	38.0	SAND-GRAVEL
38.0	78.0	CLAY
78.0	94.0	SAND-GRAVEL

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology *Plot this site on a topographic map*
Ground-Water Information Center Site Report
MCLEAN TROY & AUDRA

Location Information

GWIC Id:139271
Location (TRS):13N 20W 14 AAB
County (MT):MISSOULA
DNRC Water Right:
PWS Id:
Block:2
Lot:23
Addition:MULLAN TRAIL
Source of Data:LOG
Latitude (dd):46.8914
Longitude (dd):-114.0846
Geomethod:TRS-SEC
Datum:NAD27
Altitude (feet):
Certificate of Survey:
Type of Site:WELL

Well Construction and Performance Data

Total Depth (ft):119.00
Static Water Level (ft):21.00
Pumping Water Level (ft):50.00
Yield (gpm):100.00
Test Type:AIR
Test Duration:1.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:
How Drilled:ROTARY
Driller's Name:CAMP
Driller License:WWC007
Completion Date (m/d/y):11/3/1993
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer:112ALVM
Well/Water Use:DOMESTIC

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	119.0	6.0				STEEL

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
119.0	119.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	6.0	CLAY
6.0	21.0	CLAY- SAND & GRAVEL
21.0	33.0	CLAY- SAND- GRAVEL & WATER
33.0	79.0	CLAY
79.0	85.0	SAND & WATER
85.0	91.0	CLAY
91.0	94.0	SAND & WATER
94.0	99.0	CLAY- SAND- GRAVEL & WATER
99.0	116.0	SAND & WATER
116.0	119.0	SAND- GRAVEL & WATER

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology *Plot this site on a topographic map*

Ground-Water Information Center Site Report

MULLAN TRAIL ENTERPRISES

Location Information

GWIC Id:145916
Location (TRS):13N 20W 14 AAB
County (MT):MISSOULA
DNRC Water Right:
PWS Id:
Block:2
Lot:22
Addition:MULLAN TRAIL PHASE 2
Source of Data:LOG
Latitude (dd):46.8914
Longitude (dd):-114.0846
Geomethod:TRS-SEC
Datum:NAD27
Altitude (feet):
Certificate of Survey:
Type of Site:WELL

Well Construction and Performance Data

Total Depth (ft):119.00
Static Water Level (ft):22.00
Pumping Water Level (ft):60.00
Yield (gpm):100.00
Test Type:AIR
Test Duration:1.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:
How Drilled:ROTARY
Driller's Name:CAMP
Driller License:WWC007
Completion Date (m/d/y):10/27/1994
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer:112ALVM
Well/Water Use:DOMESTIC

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	119.0	6.0				STEEL

Annular Seal Information

From	To	Description
0.0	20.0	BENTONITE

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
119.0	119.0	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	12.0	CLAY
12.0	24.0	CLAY SAND AND GRAVEL
24.0	31.0	CLAY SAND GRAVEL AND WATER
31.0	62.0	CLAY
62.0	91.0	CLAY SAND AND WATER
91.0	111.0	SAND AND WATER
111.0	119.0	SAND GRAVEL AND WATER

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology *Plot this site on a topographic map*
Ground-Water Information Center Site Report
PEWITT LENNIS

Location Information

GWIC Id:154091
Location (TRS):13N 20W 13 BBB
County (MT):MISSOULA
DNRC Water Right:
PWS Id:
Block:
Lot:25
Addition:44 RANCH ESTATES
Source of Data:LOG
Latitude (dd):46.8914
Longitude (dd):-114.0797
Geomethod:TRS-SEC
Datum:NAD27
Altitude (feet):
Certificate of Survey:
Type of Site:WELL

Well Construction and Performance Data

Total Depth (ft):92.50
Static Water Level (ft):25.00
Pumping Water Level (ft):28.00
Yield (gpm):50.00
Test Type:PUMP
Test Duration:1.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:
How Drilled:CABLE
Driller's Name:CKC
Driller License:WWC185
Completion Date (m/d/y):9/30/1995
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer:112ALVM
Well/Water Use:DOMESTIC

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	92.5	6.0				STEEL

Annular Seal Information

From	To	Description
0.0	18.0	BENTONITE

Completion Information[1]

From	To	Dia	# of Openings	Size of Openings	Description
92.5	92.5	6.0			OPEN BOTTOM *

Lithology Information

From	To	Description
0.0	10.0	TOPSOIL
10.0	28.0	SAND GRAVEL &C LAY
28.0	40.0	SILTY SAND & CLAY
40.0	80.0	CLAY
80.0	89.0	CLAY SAND & GRAVEL
89.0	92.5	SAND GRAVEL & WATER

[1] - All diameters reported are **inside** diameter of the casing.

Appendix D

Appendix E

Appendix F

Appendix G

Appendix H

Appendix I