PWS-6 REPORT

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Clark Lookout Major Subdivision
Dillon, Montana

Public Water Supply System

Owner:
Benny Reynolds

Operator:
Clayton Hildreth

Produced by:
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November 20,2001

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INTRODUCTION

This PWS-6 report is produced by Willis Weight, Ph.D, P.E., Hydrogeologist, and Janell Foley, Hydrogeologist for the Clark Lookout Major Subdivision public water supply system (PWS# pending) located in Beaverhead County near Dillon, Montana. The subdivision owner and the operator and primary contact person are listed below:

Owner:
Benny Reynolds Highway 41
Twin Bridges, MT 59754
(406) 684-5204

Operator and Primary Contact Person:
Clayton Hildreth
435 South Atlantic
Dillon, MT 59725
(406) 683-4460

Federal regulations (Safe Drinking Water Act) and Montana State regulations (Montana Source Water Protection Program) require a PWS-6 report for all new public water supply systems. The Safe Drinking Water Act (SDWA) was established by federal government to set drinking water standards and health goals, and the Montana Source Water Protection Program (SWPP) was created to help protect public water supply systems from sources of contamination.

The purpose of this report is to delineate a source water protection area around the public water supply well for the Clark Lookout Major Subdivision near Dillon, Montana and assess possible sources of contamination to the source water. This report meets the following basic technical requirements for completion of a PWS-6 report: [1]

1. Background Information
2. Source Water Protection Area Delineation
3. Inventory of Potential Sources of Contamination
4. Assessment of Susceptibility to Contamination

Section 1 gives background information that describes the community and geographic setting, the geology and hydrogeology of the area, the general ambient water quality, and gives a description of the public water supply system. Section 2 presents delineation boundaries along with a discussion of the delineation method. Section 3 presents an inventory of the potential sources of contamination to the public water supply well and section 4 discusses the susceptibility of the public water supply well to contamination.

Limitations

This report may unintentionally miss some important sources of contamination in the inventory. Should new information become available or new developments occur, this report will be periodically updated.

1. BACKGROUND INFORMATION

1.1 Site Location

The Clark Major Lookout Subdivision is located approximately 1 ½ miles north of Dillon, Montana in the SE ¼ of the NW ¼ of Section 12, Township 7 South, Range 9 West and the SW ¼ of Section 7, Township 7 South, Range 8 West (Figure 1). The subdivision can be accessed via Lovers Leap County Road off Highway 91. There are 63 residential lots proposed on approximately 50 acres of land. The lot sizes range from 0.6 to 2.46 acres. A plat map of the subdivision is provided in Appendix A. Water will be supplied to 55 lots by an eight-inch diameter water supply well and distribution system located on the subdivision property. The remaining lots will have individual ground water wells.

1.2 The Community

Dillon is a small ranching community located in Beaverhead County in southwest Montana. Dillon is the County Seat of Beaverhead County, the largest county in Montana, with a population of approximately 9000 (2000 Census). Beaverhead County is the largest producer of cattle and hay, and the second largest producer of sheep in the State. Originally a mining and railroad town dating back to the 1800's, Dillon's current principle industry is agriculture; Dillon also relies on tourism, mining, government, and education for its financial base. 2 Dillon is home to Western Montana College and its approximately 1100 students. The College promotes and sponsors art, music, and theater that influence the ranching culture of the area and adds to its economic base.

1.3 Geographic Setting

The city of Dillon is located at an elevation of approximately 5100 feet in an intermontane basin situated between the Pioneer Mountains to the Northwest and the Ruby Range to the East and the Blacktail Range to the South. There is approximately 5000 feet of relief between the valley and the mountain peaks of the Pioneer Mountains near Dillon. Dillon is located in the Beaverhead sub-basin, part of the Upper Missouri Watershed region, headwaters for the Missouri River. The surrounding mountains drain their creeks and streams into the Beaverhead River that occupies the valley floor and flows northeast to join with the Ruby and Bighole Rivers northeast of Dillon, near Twin Bridges, Montana. The Beaverhead River is the main surface water feature in this area and is located approximately 3000 feet to the southeast of the Clark Lookout Major Subdivision public water supply well.

1.4 Land Use

Land use near Dillon is primarily agriculture and rangeland (Figure 2). Land use near and upgradient of the Clark Lookout Subdivision is mainly rangeland. Land cover is dry land grasses and sagebrush.

1.5 Geology

Tertiary volcanics make up the Pioneer Mountain bedrock northwest of the subdivision and Quaternary alluvial deposits make up the valley floor (Figure 3). The volcanics in this area

include mainly andesitic basalts, andesites, and dacites.[3,4]

1.6 Hydrogeology

Three test well boreholes drilled on the subdivision property indicate over 180 feet of sedimentary deposits consisting of gravel, sand, and clay layers. The well locations are shown on Figure 4. The subdivision public water supply well located approximately eight feet northeast of test well #3 was drilled into Tertiary volcanic bedrock between 180 and 220 feet. Well logs for the subdivision test wells and the public water supply well are included in Appendix B. Other nearby wells drilled into Tertiary volcanics include Dillon public water supply wells # 1 and #2 located approximately 1.5 miles west of Dillon. These wells were drilled into Tertiary volcanics at depths of 124 and 84 feet, respectively.[5]

A 24-hour pumping test was conducted in the subdivision water supply well on September 28-29,2001. A pumping rate 300 gpm was maintained throughout the test and the drawdown and recovery data were recorded using a pressure/transducer data logger system in test well #3, located approximately eight feet southwest of the pumping well. Drawdown stabilized in test well #3 in 21.5 hours at 0.6 feet. Drawdown was not observed in the other two test wells. Test wells #1 and #2 are completed in the overlying sediments and are located approximately 1500 feet from the water supply well. From the results of the pumping test and recovery data, a hydraulic conductivity value is estimated to be 810-2260 ft/day. Hydraulic conductivity values estimated for Dillon public water
supply wells #1 and #2 are 793 and 306 ft/day, respectively.[5]

Static water levels were measured in the three test wells located on the subdivision property on September 28, 2001. Table 1 presents the ground water elevations for the three test wells and Figure 4 shows the ground water flow direction. A hydraulic gradient was calculated to be 0.014 ft/fl. The pumping test and recovery data are included in Appendix B.

Table 1. Ground Water Elevations (ft msl)

Well ID	Well Elevation	Date	SWL	Ground Water Elevation
Test Well #1	5124.79	9/28/01	53.5	5071.29
Test Well #2	5139.35	9/28/01	65.79	5073.56
Test Well #3	5204.51	9/28/01	111.5	5093.01

1.7 General Water Quality

General ambient water quality for the deeper wells in Township 7 South, Range 9 West is a calcium-sodium-bicarbonate or -sulfate type of water. The pH range is neutral and specific conductance ranges from approximately 300-570 μmhos/cm. The general water quality for the Beaverhead River floodplain is categorized as a calcium-sodium-bicarbonate water type.[3]

2. SOURCE WATER PROTECTION AREA DELINEATION

The public water supply well for the Clark Lookout Major Subdivision is completed in a bedrock aquifer system that is confined due to overlying clay and clay-bound layers. Because the water supply well is deep and confined, the source water sensitivity is low. Delineation requirements include a 1 DO-foot radius control zone, an inventory zone, and a recharge zone around the public water supply well. The delineations are shown in Figure 5.

2.1 Method

The aquifer system is confined, therefore in accordance with the SWPP, the delineation for the inventory zone is a 1000-foot fixed radius around the public water supply well. This delineation method may be more reasonable than using the Department of Environmental Quality's (DEQ) time of travel method.[6,7] Using the aquifer parameters shown in Table 2 and the time of travel method, a three-year time of travel distance is

Table 2. Aquifer Parameters

Parameter	Value or Range	How Determined
Pumping Rate (Q)	57,754 ft^3/day (300 gpm)	Measured during pumping test
Porosity	0.10-0.15	Reference [5,6]
Hydraulic Conductivity (K)	1000 ft/day	Calculated from pumping test data
Aquifer Thickness (b)	40 feet	"Screened" section of well
Hydraulic Gradient	0.014 ft/ft	Calculated from SWL measurements

calculated to be approximately 19 miles. A lateral boundary limit of 16 miles is calculated at ±22.5 degrees out from the centerline 19 miles upgradient from the water supply well. The assumption that ground water flow direction and aquifer characteristics are consistent for nineteen miles is unrealistic, therefore a 1000- foot fixed radius for an inventory zone is reasonable considering the 220-foot depth of the bedrock well and the confining nature of the aquifer system.

3. INVENTORY OF POTENTIAL SOURCES OF CONTAMINATION

Land use within the control zone and the inventory region is currently designated as rangeland (66% rangeland and 33% shrubland)[7] but will become unsewered residential when the Clark Lookout Major Subdivision development is complete. Possible sources of contamination are spills associated with residential and maintenance activities and septic systems (Table 3). Land use within the recharge area is predominantly shrub land and grassland that does not warrant a hazard rating.

Table 3. Inventory of Source of Contamination

Region	Land Use	Source of Contamination
Control Zone	Unsewered Residential	Spills from residential or maintenance activities Septic systems
Inventory Region	Unsewered Residential	Spills from residential or maintenance activities Septic Systems

The Natural Resource Information System (NRIS) data base was queried for the following possible sources of contamination:

- waste water discharge locations
- landfills
- comprehensive mine locations
- superfund sites
- hazardous spill sites
- underground storage tank locations
- septic systems

There is a waste water treatment facility to the east of the subdivision, however the facility is on the east side of the Beaverhead River and downgradient of the public supply well; there are no feedlots near the subdivision. There are no landfills, no major Montana State clean up or EPA Superfund sites, or hazardous spill sites near the inventory region. There are underground storage tank releases reported for Dillon, however they are downgradient and located primarily on the east side of the Beaverhead River. Septic density currently is low, however the density will become moderate (50 to 300 per square mile) when subdivision development in the area is complete. Less than half of the subdivision lots are situated up gradient of the water supply well.

Nitrates and pathogens from septic systems are currently the only major contaminants of concern.

4. ASSESSMENT OF SUSCEPTIBILITY TO CONTAMINATION

Because the subdivision water supply well is completed in a confined aquifer, and there are no other wells completed in the aquifer, the susceptibility to contamination for all hazards is considered low in accordance with the SWPP[9]. The majority of the layers overlying the production zone are clay and clay-bound sediments that create a barrier to contamination. The major contaminants of concern are nitrates and pathogens associated with septic systems, however septic system density is low. Susceptibility is also decreased by the proper completion of the subdivision test wells and water supply well that are sealed with bentonite.

REFERENCES

1. MDEQ, Department Circular PWS6, Source Water Protection Delineation, 1999 Edition.

2. Beaverhead Chamber of Commerce Brochure on Southwestern Montana, Beaverhead County, Dillon, County Seat, Travel Montana, Dpt. Of Commerce, 29p.

3. Uthman, W. and Beck, J. (1998) Hydrogeology of the Upper Beaverhead Basin near Dillon, Montana, MDNRC, MBMG Open File Report #384, Helena, MT, 549p.

4. Pope, D.A., et al. (1999) Hydrogeological, Geophysical, Water-Quality, Transient-Tracer, and Flow-Model Analysis of the Ground-Water Flow System near Dillon, Montana, USGS Water-Resources Investigations Report #98-4250, 75p.

5. MUSWC (1999) Montana Source Water Protection Technical Guidance CD-Rom, Dillon Data, The Montana University System Water Center, Bozeman, Montana.

6. Weight, W. and Sonderegger, J. (2001) Manual of Applied Field Hydrogeology, McGraw Hill, New York, NY, 608 p.

7. Personal Communication Carolyn DeMartino, SWPP.

8. Instructions for Completing a PWS-6 Report for Community or Non-Community Non-Transient Public Water Supplies, DEQ, 4/25/01, Helena, MT.

9. Personal Communication Jim Stimson, SWPP.

Figure 1. Location of the Clark Lookout Major Subdivision north of Dillon

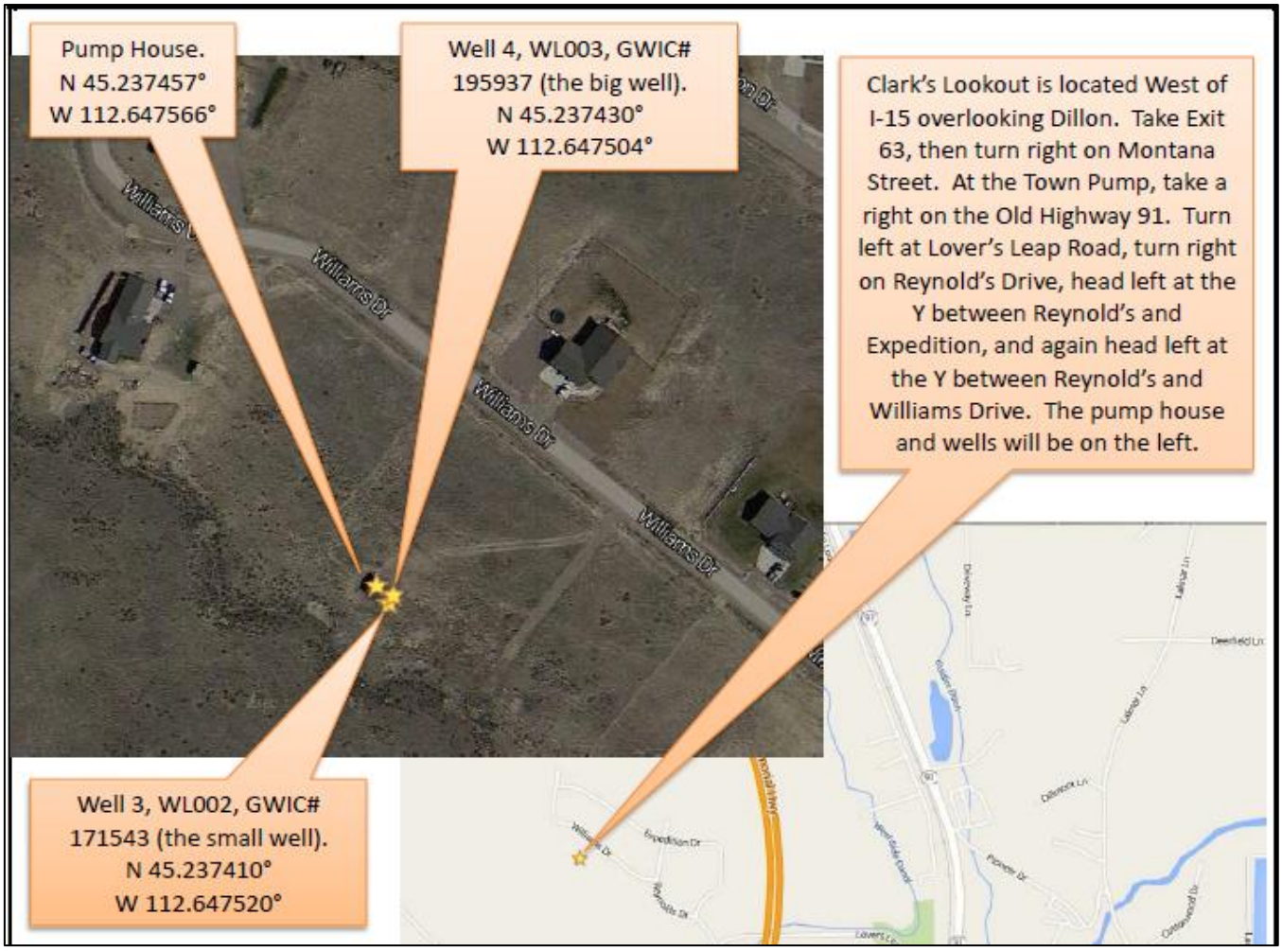


Figure 2. Land use near Dillon, Montana

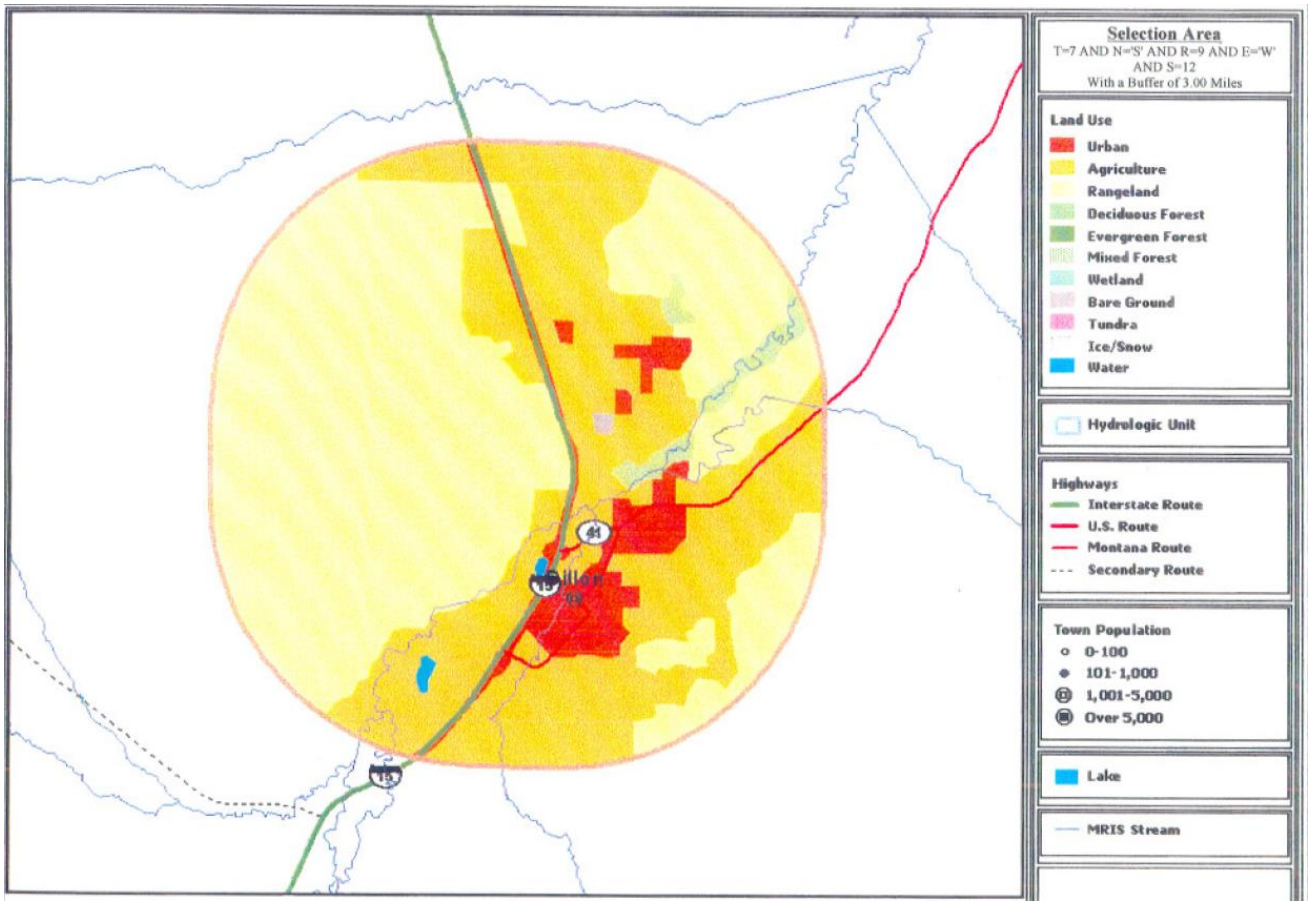


Figure 3. The general geology near Dillon, Montana

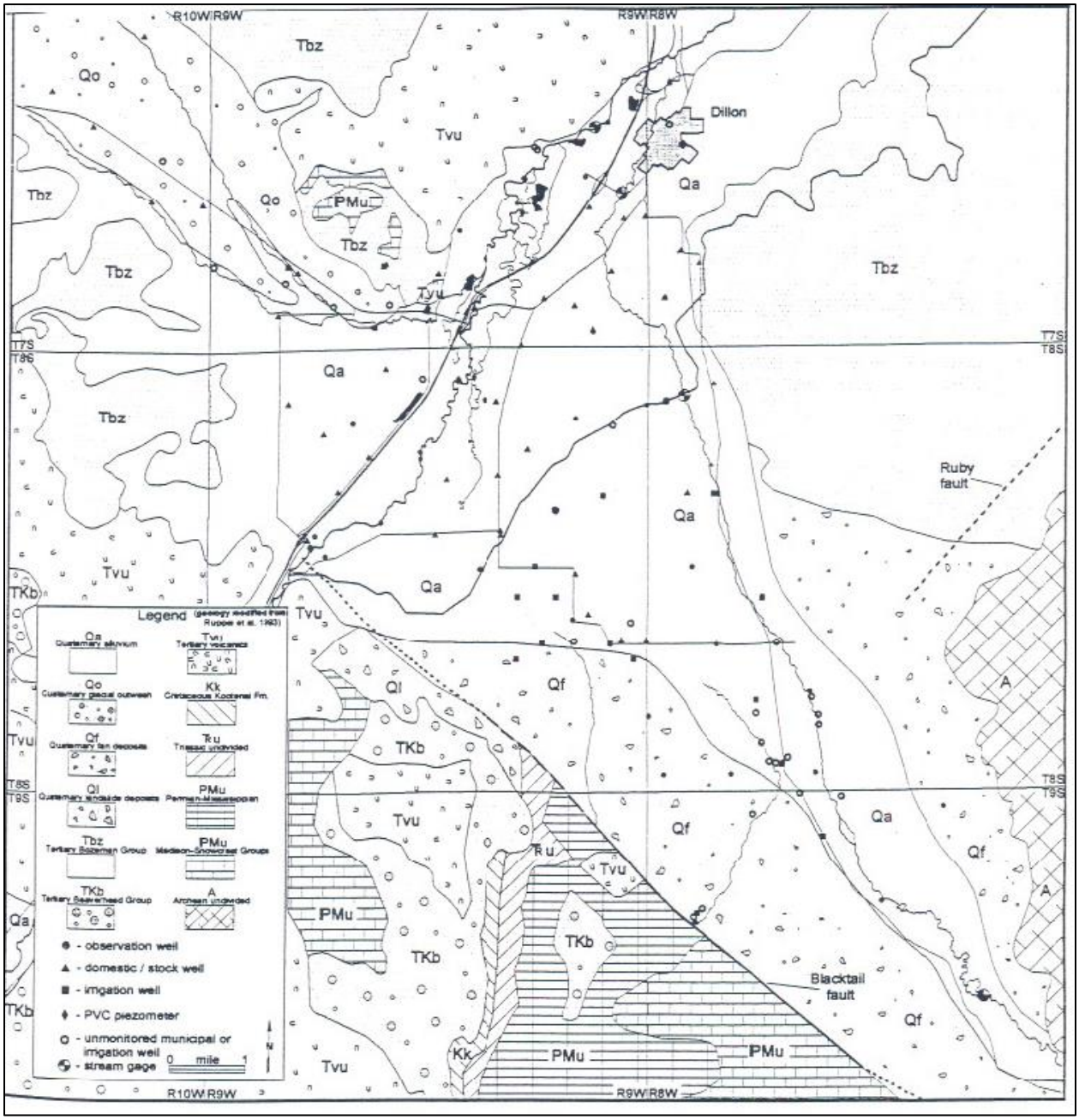


Figure 4. Clark Lookout ground water flow direction and hydraulic gradient

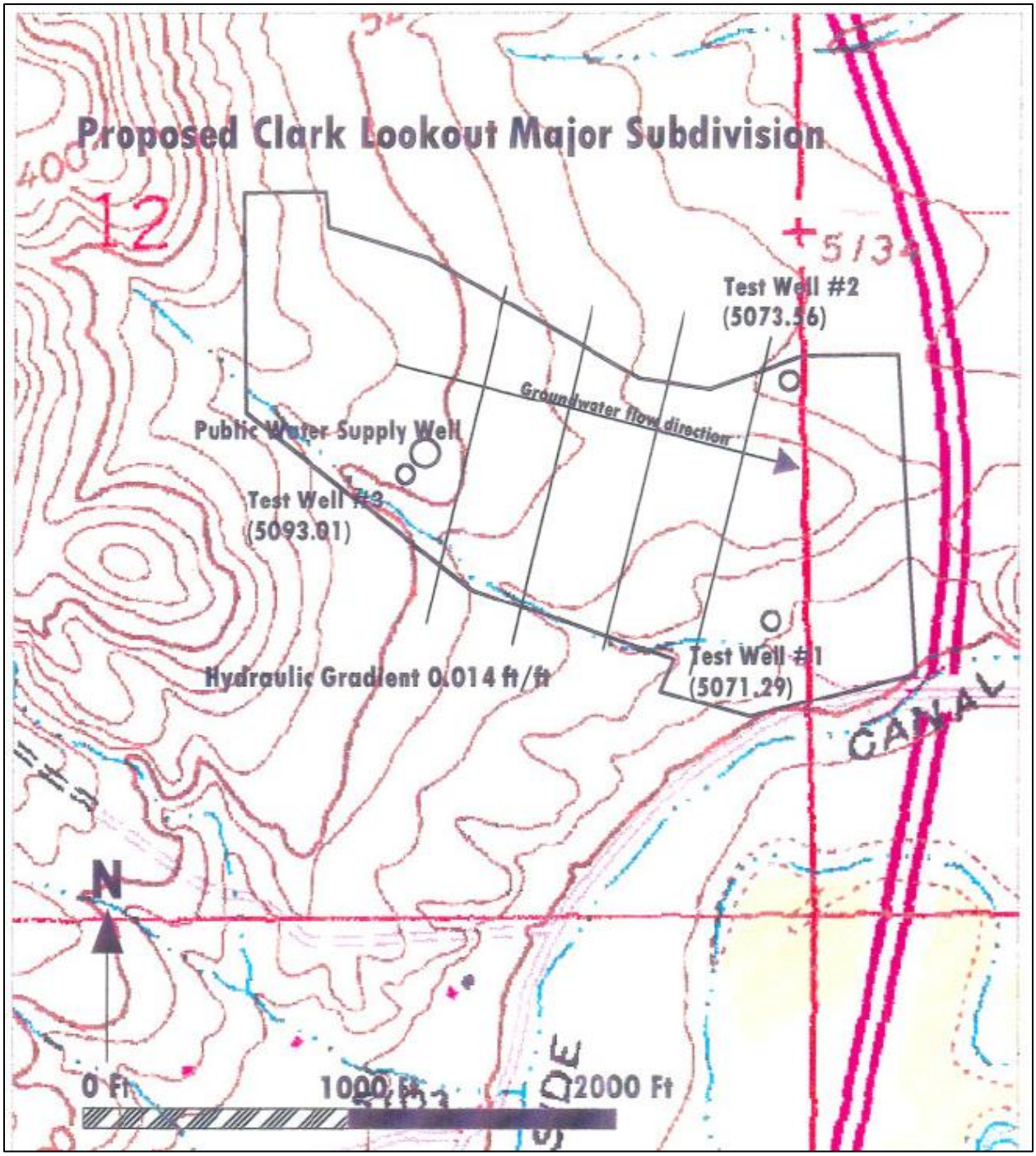
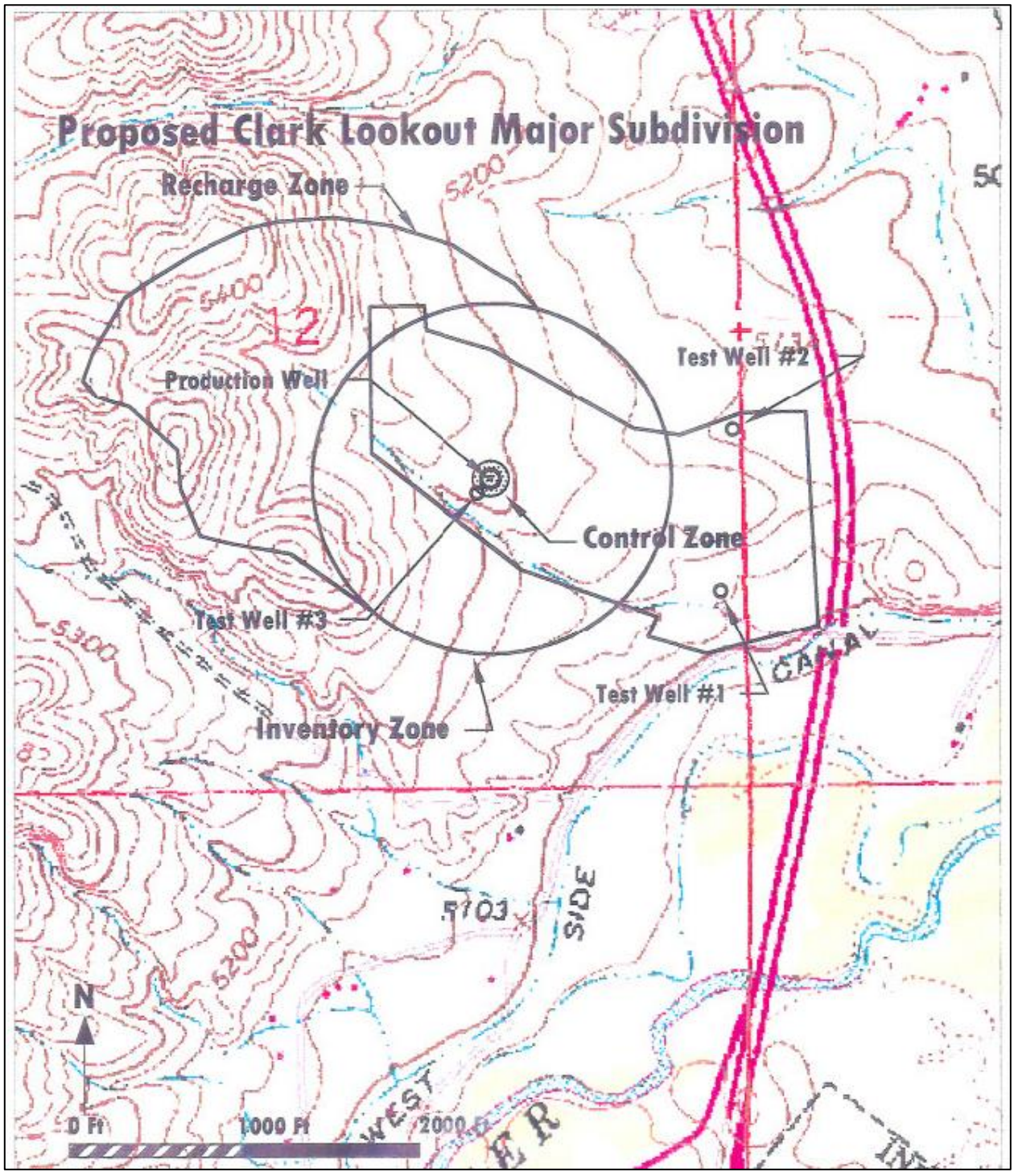


Figure 5. Clark Lookout Major Subdivision control, inventory, and recharge zones



Driller's Logs
Well 3 (WL002)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (6/27/2006 10:13:25 AM)

Site Name: HILDRETH CLAYTON
GWIC Id: 171543

Section 1: Well Owner(s)
1) CLAYTON, HILDRETH (MAIL)
435 SOUTH ATLANTIC
DILLON MT 59725 [03/23/1999]

Section 2: Location

Township	Range	Section	Quarter Sections
07S	09W	11	NE¼ SE¼

County	Geocode
BEAVERHEAD	

Latitude	Longitude	Geomethod	Datum
45.237917	112.664192	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
TEST WELL (1)

Section 4: Type of Work
Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Tuesday, March 23, 1999

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	180	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	178	6			WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
178	180	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 180
Static Water Level: 145
Water Temperature:

Air Test *

60 gpm with drill stem set at _ feet for 4 hours.
Time of recovery 0.08 hours.
Recovery water level 111.92 feet.
Pumping water level 178 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	5	SANDY TOPSOIL
5	15	GRAVEL AND CLAY
15	53	COARSE ANGULAR ROCK
53	128	CLAYBOUND SMALL BLACK GRAVELS
128	135	GRAY CLAY
135	162	BROWN CLAY WITH SMALL GRAVELS
162	178	BROWN CLAY
178	180	COARSE CLEAN BLACK GRAVELS

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: GRAHAM DRILLING INC
License No: WWC-40
Date Completed: 3/23/1999

Driller's Logs
Well 4 (WL003)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (6/27/2006 10:12:55 AM)

Site Name: HILDRETH CLAYTON
GWIC Id: 195937
DNRC Water Right:

Section 1: Well Owner(s)
1) HILDRETH, CLAYTON (MAIL)
435 SOUTH ATLANTEC
DILLON MT 59725 [08/31/2001]

Section 2: Location

Township	Range	Section	Quarter Sections
07S	09W	12	NW¼ SE¼

County	Geocode
BEAVERHEAD	

Latitude	Longitude	Geomethod	Datum
45.238146	112.649148	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Friday, August 31, 2001

Section 6: Well Construction Details
Borehole dimensions

From	To	Diameter
0	220	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	179	8				CASING
175	220	6				CASING

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
179	220	6			PERFORATED CASING

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 220
Static Water Level: 111.58
Water Temperature:

Air Test *

300 gpm with drill stem set at 112 feet for 24 hours.
Time of recovery 9 hours.
Recovery water level 111.73 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	2	TOPSOIL
2	38	CLAY AND ROCKS
38	176	VOLCANIC BEDROCK WITH CLAY
176	220	VOLCANIC BEDROCK WITH FRACTURED WATER

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: LINDSAY DRILLING CO INC
License No: WWC-253
Date Completed: 8/31/2001