Grant Creek Water Users' Association

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Grant Creek Water Users' Association

Public Water System

PWSID # MT0003305

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ACKNOWLEDGMENTS

This Delineation and Assessment Report for the Grant Creek Water Users' Association PWS (source #003305) was completed by Michelle Hutchins, Jon Harvala, and Travis Ross, Environmental Health Specialists with the Missoula Valley Water Quality District. The Missoula Valley is located in Missoula County. The system can be contacted through Andy Mefford (406) 728-1880.

GLOSSARY
AND
LIST OF ACRONYMS*

Acute Health Effect An adverse 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.

AST Aboveground storage tank.

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

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

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

Confining Unit A geologic formation that inhibits the flow of water.

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.

Delineation A process of mapping source water management areas.

DEQ Montana Department of Environmental Quality.

EPA United States Environmental Protection Agency.

GWIC Ground-Water Information Center online well database administered by the Montana Bureau of Mines and Geology.

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

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

HazMat Hazardous Materials Response Team.

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

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

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.

MGWPCS Montana Ground Water Pollution Control System.

MPDES Montana Pollution Discharge Elimination System.

NOAA National Oceanic and Atmospheric Administration.

Nitrate An important plant nutrient and type of inorganic fertilizer. In water, the major sources of nitrate pollution are septic tanks, sanitary sewers, feed lots and fertilizers.

Nonpoint-Source Pollution Pollution sources such as stormwater runoff that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet.

NPL National Priority List (Superfund).

Pathogens Bacterial organisms 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.

Public Water System A system that provides piped water for human consumption to 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 Source water management region that is generally the entire area that could contribute water to an aquifer used by a public water system. 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.

SDWA Safe Drinking Water Act.

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

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

Susceptibility (of a PWS) The potential for a public water system to draw water with contamination 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) Manmade organic chemical compounds such as 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.

Transmissivity The ability of an aquifer to transmit water.

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

USGS United States Geological Survey, Dept. of Interior.

UST Underground storage tank.

Volatile Organic Compounds (VOC) Any organic compound that evaporates readily to the atmosphere.

MWQA Montana Water Quality Act.

WQD Missoula Valley Water Quality District.

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

INTRODUCTION

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Grant Creek Water Users' Association PWS 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 the Grant Creek Water Users' Association PWS.

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 the Grant Creek Water Users' Association PWS 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 Grant Creek Water Users' Association PWS operator and the community to complete a source water protection plan that meets their specific needs.

CHAPTER 1
BACKGROUND

The Community

The city of Missoula is located in the Missoula Basin at the southern end of the Missoula-Ninemile Valley (Figure 1). The population of Missoula County in 2000 was 95,802 with 57,053 people living in the city of Missoula (Census 2000). The Bitterroot River enters Missoula from the south and the Clark Fork River enters from the northeast. US Highway 93 serves Missoula from the south and the north and Interstate 90 passes along the northern edge of Missoula (Figure 2). Major Missoula area employers include the University of Montana, and the two local hospitals, each employing more than 1000 people. Stimson Lumber operates a lumber and plywood mill in the Bonner area, and employs 450 people. Other economic contributors include Smurfit-Stone Container, several transportation companies, as well as tourism, small businesses and outlying agriculture and timber operations. Wastewater from the community is collected in one sanitary sewer system, which, after treatment, discharges into the Clark Fork River near the western edge of Missoula. Surrounding areas rely on onsite sewage disposal systems. Mountain Water Company supplies Missoula residents and businesses with the majority of the city's drinking water; depending on location, some properties are served by individual or small public water supply wells.

Geographic setting

Missoula is located in the southern end of the Missoula-Ninemile Valley as shown in Figure 1. The valley elevation ranges from approximately 3000 to 3200 feet above sea level, with surrounding mountain ranges, including the Sapphire Range to the east, the Bitterroot Range to the south, the Rattlesnake Range to the north, and the Ninemile Divide to the west, rising to elevations of 5000 to 8000 feet. The Clark Fork and Bitterroot Rivers drain the valley; the Clark Fork flows westward through the valley, and the Bitterroot flows across the southwest corner of the valley, and joins the Clark Fork at Kelly Island, approximately 4 miles west of the City of Missoula. Milltown Dam and Milltown Reservoir are located approximately 5 miles upstream from Missoula at the confluence of the Clark Fork and Blackfoot Rivers. Grant Creek originates from headwaters in mountain terrain of the Lolo National Forest, adjacent to the Rattlesnake Wilderness Area, and drains residential and agricultural land before flowing into the Missoula Valley near the northwest corner of Missoula. Grant Creek flow is then channelized and diverted before it reaches the Clark Fork River. Flow from Grant Creek and its alluvial aquifer recharge the Missoula Aquifer, which has been designated a "sole-source" aquifer by the United States Environmental Protection Agency.

The climate in Missoula is typical of western Montana. Missoula receives approximately 13.5 inches of rain per annum, and 45 inches of snow. The annual average temperature is 44°F with average maximum temperatures occurring in July (83°F) and average minimum temperatures occurring in January (15°F).

General description of the Source Water

The Grant Creek Water Users' Association wells are completed in the Grant Creek alluvial aquifer. The aquifer consists primarily of unconsolidated alluvial sand, gravel and cobbles and is recharged mainly by Grant Creek, precipitation/snowmelt from the Grant Creek watershed, and drainage from fractured bedrock in the surrounding mountains.

The Public Water Supply

The Grant Creek Water Users' Association PWS is a community water system that obtains water from two wells finished in the Grant Creek alluvial aquifer. The wells are located north of Missoula off Grant Creek Road, in Missoula County. The wells draw from 60 and 75 feet below the ground surface. The Grant Creek Water Users' Association PWS currently serves an estimated population of 350 with 140 active service connections. The locations of the wells are shown in Figure 2. The water is chlorinated, and then stored in 3 reservoirs, prior to gravity distribution. A general plan showing the layout of the distribution system is presented in Appendix A, with a copy of the sanitary survey.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. Water is typically monitored for total coliform and fecal coliform, nitrates, metals and chemicals. The monitoring schedule depends on the population served, the number of wells and the source water for the PWS. DEQ defines monitoring programs and protocols that are specific to each PWS. The Grant Creek Water Users' Association PWS had reported violations of the total coliform MCL in October of 1994 and June of 1995.

Table 1 lists typical constituents of groundwater in the Grant Creek area.

Table 1. Sample water quality data for the Missoula Aquifer, Grant Cr. Area (WQD, 1996-2003; MDEQ analytical results, 1995-2001).

Sample date	Well #/ Location	pH	Ca Mg/L	$S0_4$ Mg/L	NO_3 Mg/L	Cl Mg/L	Fl^- (Mg/L	As Mg/L	Ba Mg/L	Organic Contaminants
1996 - 2003 (Ave.)	WQD # 4; PWS 437, 828, 3305. 13N19W 6,7; 14N19W 32	7.2	24.4	4.49	1.09	3.6	<0.0005	0.0006	0.15	None Detected

Table 2. Water quality data for Grant Creek Water Users' Association (MDEQ, PWS analytical results, 1995-2001).

Sample Date	Well #/ Location	pH	Ca (Mg/L)	SO_4 (Mg/L)	NO_3 (Mg/L)	Cl (Mg/L)	Fl^- (Mg/L)	As (Mg/L)	Ba (Mg/L)	Organic Contaminants
1995-2001 (Ave.)	PWS #3305 – 14N19W, sect. 29	7.1	12.1	1.9	0.33	3	<0.0005	<0.0005	0.05	None Detected

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to the Grant Creek Water Users' Association PWS, is identified in this chapter. Four management areas are identified within the source water protection area: the control zone, inventory region, surface water buffer zone 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 surface water buffer zone is delineated based on standard distance criteria of 10 miles upstream from the ground water inventory zone and encompasses ½ mile width of land area on each side of the drainages. The recharge region represents the entire portion of the aquifer that contributes water to the Grant Creek Water Users' Association water system.

Hydrogeologic Conditions

Geologic and hydrogeologic studies of the Missoula area are listed in Table 3, with a summary of maps listed in Table 4. The following description is derived from these reports.

The Grant Creek alluvial aquifer drains into the Missoula Valley aquifer. The Missoula Valley is part of a structural basin that began to open about 65 million years ago, during the early Tertiary crustal movement that created the Rocky Mountains. Precambrian metasedimentary rocks of the Belt Supergroup, and a few interspersed Paleozoic sedimentary rocks surround the valley, with peaks of 5000 to 7000 feet elevation. This relatively impermeable and deeply eroded landscape was partially filled with Tertiary and Quaternary alluvium, and Glacial Lake Missoula clays and silts. Portions of the Tertiary sediments were scoured from the valley during the repeated draining of Glacial Lake Missoula approximately 12,000 to 15,000 years ago, during the Wisconsin glacial stage, and were replaced with layers of sand, gravel and cobbles, deposited during these catastrophic events and more recent alluvium deposited along the river channel and flood plain. The sediments generally become finer to the southwest of the valley as a result of dissipating energy after sediment-carrying water flowed out of Hellgate Canyon and across the broader Missoula Valley, depositing coarser sediments first and then gradually allowing deposition of finer sediments.

The Grant Creek aquifer is unconfined to semi-confined, and composed of unconsolidated Quaternary alluvium. The Quaternary alluvium in this area consists primarily of clay, sand, gravel and boulders. Layers of clay and silt deposited in Glacial Lake Missoula are interfingered with sand and gravel layers that were deposited between the multiple episodes of draining and refilling the Lake, creating a complex stratigraphy, with some semi-confined, water- bearing layers. Tertiary deposits (mostly Renova and Sixmile-Creek equivalents) flank and underlie the area of Quaternary alluvium, but Renova Equivalent sediments are generally fine-grained and much less productive than the more recent deposits; probable Sixmile Creek Equivalent sediments do yield useable quantities of water in some parts of the Missoula Valley. Some wells in the outlying areas of the valley are finished in Precambrian bedrock, but these derive water mainly from fractures and are also much less productive than the main water-bearing alluvium. Depth to the water table ranges up to approximately 40 feet below land surface in the Grant Creek area, depending on drought conditions and distance from streams. The seasonal fluctuation of the groundwater table is approximately 17 feet (Pottinger, 1988), depending upon proximity to the recharge source and hydraulic conductivity of the surrounding aquifer sediments. The maximum width of the Grant Creek alluvial aquifer is approximately 2/3 miles. Groundwater flows generally south

southwestward through the Grant Creek Water Users' Association area, roughly paralleling Grant Creek. The aquifer in this area is classified as having high source water sensitivity, because it is unconfined and comprised of unconsolidated alluvium. The Missoula Valley Aquifer has been designated a "Sole Source Aquifer" by the U.S. EPA. A geologic map of the Missoula area is presented in Figure 3. Figure 4 represents a generalized ground water flow map. Geologic cross sections are shown in Figure 5.

Table 3. List of geologic or hydrogeologic investigations for the Missoula area.

Title of Project	Reference	Area Covered	Project Purpose.
Interactions Between the Clark Fork River and Missoula Aquifer, Missoula County, Montana	K.W. Clark, 1986	Missoula Valley	Define hydrogeology of Clark Fork River and Missoula Aquifer.
Hydrogeology and water resources of the Missoula Basin, Montana	A.L. Geldon, 1980	Missoula Basin	To determine the storage potential of the basin.
Geographic, Geologic, and Hydrologic Summaries of Intermontane Basins of the Northern Rocky Mountains, Montana	Kendy and Tresch, 1996.	Intermontane basins of the northern Rocky Mountains	Summarize the geographic, geologic and hydrologic characteristics of the Rocky Mountain region in western Montana.
Geology and Ground-water Resources of the Missoula Basin, Montana	McMurtrey, et. al, 1965	Missoula Basin	Summary of geology and hydrogeology
A Single Layer Transient Flow Model of the Missoula Aquifer	R.D. Miller	Missoula Valley	Computer model to define groundwater flow and hydraulic properties of the Missoula Aquifer.
The Source, Fate and Movement of Herbicides in an Unconfined, Sand and Gravel Aquifer in Missoula, Montana	M.H. Pottinger, 1988	North central Missoula Valley, Grant Creek area	Hydrologic properties and groundwater flow of aquifer to determine source and fate of herbicide contamination.
The Hydrogeology of the Central and Northwestern Missoula Valley	C.A. Smith, 1992	Portion of Missoula Valley	Geology, hydrologic properties, groundwater flow, interaction with river and water quality of the Missoula Aquifer.
Missoula Valley Aquifer Study: Hydrogeology of the eastern portion of the Missoula Aquifer, Missoula County, Montana	W.W. Woessner, 1988	Eastern portion of the Missoula Aquifer	To assess existing and future anthropogenic effects on the aquifer

Table 4. List of geologic or hydrogeologic maps available for the Missoula area.

Title or Description	Date	Area Covered	Reference
Geologic Map of the Missoula West 30' x 60' Quadrangle	1998	Missoula Valley west of Missoula, and Bitterroot Valley south to Stevensville, MT	Lewis, R.S., 1998. MBMG Open File 373.
Tertiary Geology of NE Flank of Missoula Valley, MT	1997	NE Missoula Valley including Grant Cr., Butler Cr. and LaValle Cr.	Harris, W.J., 1997
Geologic Map and Sections of the Bonner Quadrangle, Montana	1961	Bonner Quadrangle	Nelson and Dobell, 1961
Generalized geologic map of the Butte 1 X 2 degree quadrangle, Montana	1987	Approximately 100 X 70 mi. area of Missoula, Powell, Lewis & Clark and Deer Lodge Counties	Wallace, C.A., USGS Miscellaneous Field Studies Map MF-1925

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. This section describes the conceptual model used for this report.

The ground water in this area is generally unconfined and occurs primarily in unconsolidated Quaternary sand and gravel units, which are laterally and basally bounded by much less permeable tertiary sediments and bedrock. Tertiary sediments and fractured bedrock yield small quantities of water in some areas. Recharge is derived mainly from the Clark Fork River, underflow from the Clark Fork Valley, tributary drainages and Tertiary units flanking the valley. The Clark Fork River loses water to the aquifer along some stretches and gains water from the aquifer along other stretches of its path through the Missoula Valley (Smith, 1992; Woessner, 1988). Ground water flows generally west northwestward through this area (Figure 5).

Methods and Criteria

The Montana Department of Environmental Quality specifies the methods and criteria used for source water protection zone delineation for the Grant Creek Water Users' Association PWS (DEQ, 1999). Because the Missoula Aquifer communicates with the Clark Fork River and tributary streams in the area, Surface Water Buffer Zones were applied to the Clark Fork River and tributary drainages. Time-of-travel calculations were completed for the ground water system using the uniform flow equation (U.S.E.P.A. 1991). Using published reports, estimates of the aquifer properties were made and are discussed in the following section. The recharge area is defined as the area where the aquifer is present upgradient from the well(s). The surface water buffer zones were delineated based on standard distance criteria of 10 miles upstream from the ground water inventory zone and encompassed ½ mile width of land area on each side of the drainages.

Well(s) Information
The wells are located north of Missoula – off Grant Creek Road, in T14N, R19W, section 29. Table 5 is a summary of the wells information and Appendix B contains copies of the well logs. The average depth of the wells is 67.5 feet.

Table 5. Source well information for Grant Creek Water Users' Association PWS.

Information	Well #1	Well #2	Average of wells
PWS Source Code	03305-002	-003	--
Well Location (T, R, Sec or lat, long)	Lat: 46.9368° Long: -114 .0217°	Lat: 46.9372° Long: -114 .0227°	--
MBMG#	154496	154492	--
Water Right #	--	--	--
Date Well was Completed	--	9/25/83	--
Total Depth	60 ft	75 ft	67.5 ft
Perforated Interval	25 – 27 ft; 40 – 43 ft; 49 – 50 ft	41 – 46 ft; 60 – 65 ft	--
Static Water Level	11 ft	8 ft	9.5 ft
Pumping Water Level	--	22 ft	--
Drawdown	--	14 ft	--
Test Pumping Rate	--	60 gpm	--
Specific Capacity	--	4.29 gpm/ft	--

Model Input
Time-of-travel input values are conservative assumptions made to identify areas that potentially impact source water for the Grant Creek Water Users' Association PWS. These values assume that the general characteristics of the aquifer are the same for both wells. The criteria for selection of each value used for this delineation is summarized as follows:

Thickness: The thickness of the aquifer is estimated to be 30 ft, inferred from area well logs.
Hydraulic Conductivity: A value for hydraulic conductivity is estimated to be 700, based upon aquifer tests (Land & Water 2003; WQD, 1999 –2000; Dunn, 1979), specific capacity data from well logs, and typical hydraulic conductivities of unconsolidated alluvial deposits. We have chosen a value that should provide a conservative estimate of time-of-travel distances.

Transmissivity: The estimated value for transmissivity in this area is 21,000 ft^2/day (T = Kb, where K = hydraulic conductivity = 700 ft/day; b = aquifer thickness = 30 ft). Land and Water (2003) estimated a maximum transmissivity value of 122,000 gpd/ft (16,310 ft^2 /day) for a test well near the present PWS.
Hydraulic Gradient: The hydraulic gradient of 0.015 is taken from a hydrogeologic study by Land & Water (2003).
Flow Direction: The estimated average flow direction for the purposes of this study is due south or 180 degrees (Land & Water, 2003).
Porosity: Effective porosity is the percent of rock/sediment volume occupied by interconnected voids, and is estimated at 25%. The estimated value is considered representative of unconsolidated sand and gravel.
Pumping Rate: The estimated combined pumping rate of the wells,100 gpm, is based on Grant Creek Water Works production records.

Time-of-Travel Calculation
Travel distances for 100 days, one year and three years are calculated based on input parameters summarized below. The one-year time-of-travel distance is used in Chapter 4 to rate the hazards of potential contaminant sources.

Table 6. Estimates of input parameters used to delineate the Grant Creek Water Users' Association source water protection area.

Input Parameter	Range of Values	Values Used (Grant Creek)
PWS Source Code		**003305 –002, 003**
Transmissivity	**1740 – 140,000**	**21,000 ft^2/day**
Thickness	**10 – 140 ft.**	**30 ft.**
Hydraulic Conductivity	**174 - 1000 ft/day**	**700 ft/day**
Hydraulic Gradient	**0.0019 – 0.015**	**0.015**
Flow Direction	**135 – 225 deg.**	**180 deg.**
Effective Porosity	**20 – 40%**	**25%**
Pumping Rate	**18 – 100 gpm**	**100 gpm**
100-day TOT	**--**	**4220 ft 0.80 miles**
1-Year TOT*	**540 – 22,000 ft**	**15,400 ft 2.92 miles**
3-Year TOT*	**1520 – 65,750 ft**	**46,000 ft 8.71 miles**

*Time of Travel

Delineation Results
The results of the calculations indicate an estimated average distance of 4220 feet (0.80 miles) for a 100-day time of travel (TOT), an average distance of 15,400 feet (2.92 miles) for a one-year TOT and an average distance of 46,000 feet (8.71 miles) for a three-year TOT (we have delineated the area up to and including the headwaters of Grant Creek (9.4 miles) for simplicity). The delineated inventory zones are depicted in Figure 6 for the Grant Creek Water Users' Association PWS. The surface water buffer zones for the Clark Fork River are shown in Figure 7. The recharge region for the aquifer comprises the

aquifer upgradient from the supply wells to the headwaters of Grant Creek. A 45-degree range of groundwater flow directions was used to define the lateral boundaries of the inventory region (Figure 5).

Limiting Factors

This delineation is based on estimated aquifer properties, pumping conditions and groundwater flow conditions, and assumes uniform flow in a homogeneous aquifer. 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, and the actual transient flow and heterogeneous stratigraphy can only be roughly approximated by the above assumptions. Time-of-travel distances are estimates based on available data. We have chosen input parameter values that will give us conservative but reasonable estimates of capture zones. This should provide a protective margin for inaccuracy inherent in calculations of this nature.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for the Grant Creek Water Users' Association PWS within the control and inventory regions. Potential sources of all primary drinking water contaminants and pathogens were identified; however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Grant Creek Water Users' Association PWS inventory region are nitrate, pathogens, fuels, solvents, herbicides, pesticides, and metals. The inventory for the Grant Creek Water Users' Association PWS 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

Available databases were searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. A "windshield survey" was conducted to obtain additional information for this assessment. 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. Sewered and unsewered residential land use was identified from boundaries of sewer coverage obtained from municipal wastewater utilities. Septic system density outside of the sewered area was evaluated using the Montana Department of Revenue Computer Assisted Mass Appraisal (CAMA) database.

Step 2: 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), 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 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 (USTs), hazardous waste contaminated sites (DEQ CECRA and WQA sites), landfills, abandoned mines and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: County records were queried to identify businesses that generate, use, or store chemicals in the inventory region. The facilities include equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers.

Step 6: A "windshield survey" was undertaken to identify additional significant potential contaminant sources not listed in the databases.

Step 7: Major road and rail transportation routes were identified throughout the inventory region.

Step 8. 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:

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

Inventory Results/Control Zone
The area immediately surrounding the well is agricultural/residential land use.

Inventory Results/Inventory Region
Significant potential contaminant sources for the Grant Creek Water Users' Association PWS include nearby septic systems; fuel and chemical spills along transportation routes and the Yellowstone Pipeline (the Grant Creek branch is not currently being used); and agricultural land uses. The wells are located on land owned by Grant Creek Ranch, and this operation is included as a significant potential contaminant source due to its immediate proximity, and the active grazing of cattle around the wellhead. An irrigation ditch runs approximately 150 feet obliquely upgradient from well number one. Grant Creek Water's wells are approximately 0.94 miles from the Yellowstone Pipeline, upgradient 1.7 miles from I-90, and upgradient 2.7 miles from the railroad. Land use in the inventory region primarily consists of forest (92%), agricultural land (13%), grass/rangeland (4%), and wetland (1.1%) (USGS, 1984). Septic system density is approximately 67.6/mi^2 in the 1-year time-of-travel, and 12.9/mi^2 in the 3-year time-of-travel region. The significant potential contaminant sources within the inventory zone are listed in Table 7. The general locations of these sources are shown in Figure 10.

Inventory Results/Surface Water Buffer Zones
Significant potential contaminant sources for the surface water buffer zone are pathogens and nitrates from sewage disposal systems and agricultural land use (which may also contribute pesticides and herbicides to surface waters). The petroleum pipeline would be a potential contaminant source if the Grant Creek branch were re-activated. Septic system density for the surface water buffer zone is 12.9/mi^2. There are no permitted confined animal feeding units in the Grant Creek area. Grant Creek Water Users' Association wells are approximately 200 feet from Grant Creek.

Inventory Results/Recharge Region
The land use in the recharge area is primarily evergreen forest (93%), grass/rangeland (5%), and crop/pasture (1.4%) (USGS ,1984). Potential hazards and general land use for the area are depicted in Figure 8.

Table 7. Significant Potential Contaminant Sources for PWS #3305 Inventory Region

Facility ID#	Map ID #	Facility Name	Address/Location	Type of Facility	Potential Contaminants
		Onsite Wastewater Systems		Septic systems	Pathogens, nitrate
	Labeled	Irrigation Ditch	150 ft. upgradient	Irrigation Ditch	Pathogens, nitrate, pesticides
		Agricultural Land Use (13%)		Agriculture	Animal waste, nitrate, pesticides
		Grant Creek Ranch		Cattle ranch UST	Cattle waste, herbicides/ pesticides, fuel
	Labeled	Yellowstone Pipeline		Petroleum pipeline	Petroleum products
	Labeled	Bonanza Lime Mine Prospect	Approx. 4.5 miles upstream	Raw prospect	Fuel

Inventory Update
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
The accuracy of the inventory is limited by the accuracy of information provided by state and federal databases. The windshield survey provides a level of quality assurance that the information presented reflects actual conditions. The inventory is also limited by the accuracy of the delineation, which is discussed above.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

The susceptibility of Grant Creek Water Users' Association wells to significant potential contaminant sources is assessed in this chapter. Susceptibility is the potential for a well to be contaminated by one of the sources inventoried in the previous chapter. Hazard ratings and the presence of barriers determine susceptibility (Table 8). Hazard ratings are determined by the proximity of a potential point-source contaminant or the density of non-point source potential contaminants to the well. For the Grant Creek Water Users' Association PWS, contaminant sources within the one-year TOT were given a high hazard rating and all other sources within the inventory region were given moderate hazard rating. The susceptibility is then determined based upon the hazard and any barriers that mitigate the hazard. Barriers can be engineered structures, management actions and/or natural conditions. Spill catchments for fueling facilities and leak detection for underground storage tanks are examples of engineered barriers. Emergency planning and availability of trained hazardous materials response team, and best management practices are examples of management barriers. Clay soils, deep wells and a thick layer of substrate above an aquifer can be considered natural barriers.

Table 8. 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

For point sources, the relative hazard of the significant potential contaminant sources listed in Table 7 reflects the location of the sites relative to the PWS wells and how long ground water would take to travel from that site to the wells. For sites located within a time of travel distance of less than one year, the relative hazard is assigned as high. For the remaining sites located in the inventory region, the relative hazard assigned is moderate.

For non-point sources, the relative hazard is assigned based on the following table.

Table 9. Non-point source relative hazard ratings.

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

Table 10. Susceptibility assessment for significant potential contaminant sources in the Control Zone and Inventory Region.

Map ID#	Facility Name	Contaminant	Hazard	Barriers	Susceptibility	Management
Labeled	Irrigation ditch	Pathogens, nitrate, pesticides	High	None	High	Line or pipe ditch adjacent to wellheads.
NA	Septic density: 67.6/mi^2 - 1 yr TOT 12.9/ mi^2 – 3 yr TOT	Pathogens & nitrate	Moderate	None	High	Connections to municipal sewer.
NA	Agricultural land use 13%	Pathogens, nitrate, pesticides	Low	None	Moderate	Livestock fence around wellheads; proper use/disposal of pesticides & fertilizers.
Labeled	Yellowstone Pipeline	Petroleum products	High	Not currently active	Low (currently)	Do not reactivate this section.
Labeled	Mine	Fuel	Moderate	Inactive	Low	
Labeled	Grant Creek Ranch UST (Closed)	Fuel	Very Low	Removed	Very Low	

REFERENCES

Clark, K.W., 1986. Interactions between the Clark Fork River and Missoula Aquifer, Missoula, Montana. University of Montana, M.S. thesis, 150 p.

Driscoll, F.G., 1986. Groundwater and wells, 2nd Edition. Johnson Division, St. Paul, Minnesota.

Evans, C.A., 1998. A Constrained Gravity Model of the Central Missoula Valley and Shape of the Ninemile Fault. University of Montana M.S. Thesis, 45 p.

Fetter, C.W., Jr., 1980. Applied Hydrogeology. Charles E. Merrill, Columbus, Ohio, 488 p..

Freeze, R.A., and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, NJ, 604 p.

Geldon, A. L., 1980. Hydrogeology and Water Resources of the Missoula Basin, Montana. University of Montana, M.S. thesis, 114 p.

Harris, W.J., 1997. Defining Benefit and Hazard: Distribution of Upper And Lower Tertiary Units on the Northeast Flank of the Missoula Valley, Montana. University of Montana M.S. thesis, 97 p.

Kendy, E., and Tresch, R.E., 1996. Geographic, Geologic, and Hydrologic Summaries of Intermontane Basins of the Northern Rocky Mountains, Montana. U. S. Geological Survey Water-Resources Investigations Report 96-4025, 233 p.

Land & Water Consulting, 2003, Hydrogeologic Investigation for Proposed Supply Well, Grant Creek Water Users Association.

Miller, R.D., 1990. A Single Layer Transient Flow Model of the Missoula Aquifer. Missoula City-County Health Department Report, 253 p.

Missoula Valley Water Quality District, 1996. Evaluation of Unsewered Areas in Missoula, Montana.

Montana Bureau of Mines and Geology, Ground-Water Information Center online well log database.

Montana Department of Environmental Quality (DEQ), 1999. Montana Source Water Protection Program.

National Oceanic and Atmospheric Administration, National Climatic Data Center online database.

Nimick, D.A., 1993. Hydrology and Water Chemistry of Shallow Aquifers Along the Upper Clark Fork, Western Montana. U.S. Geological Survey Water-Resources Investigations Report 93-4052, 63 p.

Pottinger, M.H., 1988. The Source, Fate and Movement of Herbicides in an Unconfined, Sand and Gravel Aquifer in Missoula, Montana. University of Montana M.S. Thesis, 172 p.

Salvato, J.A., 1992. Environmental Engineering and Sanitation. John Wiley & Sons, Inc. pp. 285-294.

Smith, C.A., 1992. The Hydrogeology of the Central and Northwestern Missoula Valley. University of Montana M.S. Thesis, 169 p.

Solley, W.B., Pierce, R.R. and Perlman, H.A., 1998. Estimated Use of Water in the United States in 1995. U.S.G.S. Circular 1200, pp. 24 – 27.

U.S. Environmental Protection Agency, 1997. Water on Tap: A Consumer's Guide to the Nation's Drinking Water.

U.S. Geological Survey, 1984, Land Use Database.

Woessner, W.W., 1988. Missoula Valley Aquifer Study: Hydrogeology of the Eastern Portion of the Missoula Aquifer, Missoula County, Montana. University of Montana Department of Geology, 127 p.

APPENDIX A

PWS System Layout and Sanitary Survey

APPENDIX B

Well Logs for PWS

One Page Site Report -- GWICMontana Bureau of Mines and Geology
Ground-Water Information Center Site Report
GRANT CREEK WATER WORKS - WELL 1

Location Information

GWIC Id:154496
Location (TRS):14N 19W 29 DDCB
County (MT):MISSOULA
DNRC Water Right:
PWS Id:03305002
Block:
Lot:
Addition:
Source of Data:LOG
Latitude (dd):46.9368
Longitude (dd):-114.0217
Geomethod:MAP
Datum:1927
Certificate of Survey:
Type of Site:WELL
Site Notes:TRACT LOCATION BASED ON LAT\LONG FROM DEQ.

Well Construction and Performance Data

Total Depth (ft): 60.00
Static Water Level (ft): 11.00
Pumping Water Level (ft):
Yield (gpm):
Test Type:
Test Duration:
Drill Stem Setting (ft):
Recovery Water Level (ft):
How Drilled: CABLE
Driller's Name:
Driller License:
Completion Date (m/d/y):
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: 111ALVM

Recovery Time (hrs):
Well/Water Use: PUBLIC WATER SUPPLY

Well Notes:

Hole Diameter Information

From	To	Diameter
0.0	60.0	10.0

Casing Information1

From	To	Dia	Description
-6.0	60.0	10.0	40 LB STEEL

Annular Seal Information

From	To	Description
0.0	20.0	CEMENT

Completion Information1

From	To	Dia	Description
25.0	27.0	10.0	3/8 X 3 INCH PERFS
40.0	43.0	10.0	3/8 X 3 INCH PERFS
49.0	50.0	10.0	3/8 X 3 INCH PERFS

Lithology Information

From	To	Description
0.0	8.0	CLAY AND SAND GRAVEL AND BOULDERS
8.0	22.0	CLAY SAND AND GRAVEL BOULDERS AND WATER
22.0	27.0	CLAY SAND GRAVEL AND WATER
27.0	40.0	CLAY GRAVEL COBBLE STONES
40.0	43.0	CLAY SAND GRAVEL WATER-10 GPM
43.0	49.0	CLAY AND BOULDERS
49.0	50.0	CLAY GRAVEL BOULDERS WATER 30 GPM
50.0	53.0	WHITE CLAY GRAVEL BOULDERS

One Page Site Report -- GWICMontana Bureau of Mines and Geology
Ground-Water Information Center Site Report
GRANT CREEK WATER WORKS

Location Information

GWIC Id:154492
Location (TRS): 14N 19W 29 DCDA
County (MT): ISSOULA
DNRC Water Right:
PWS Id: 03305003
Block:
Lot:
Addition:
Site Notes: TRACT LOCATION BASED ON LAT\LONG FROM DEQ.

Source of Data: LOG
Latitude (dd): 46.9372
Longitude (dd) :-114.0227
Geomethod: MAP
Datum: 1927
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 75.00
Static Water Level (ft):
Pumping Water Level (ft):
Yield (gpm):
Test Type:
Test Duration:
Drill Stem Setting (ft):
Recovery Water Level

How Drilled:CABLE
Driller's Name:
Driller License:
Completion Date (m/d/y): 9/25/1983
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer:111ALVM

Recovery Time (hrs):

Well/Water Use: PUBLIC WATER SUPPLY

Well Notes:

Hole Diameter Information

From	To	Diameter
0.0	75.0	10.0

Casing Information1

From	To	Dia	Description
-7.0	75.0	10.0	40 LB STEEL

Annular Seal Information

From	To	Description
0.0	20.0	CEMENT

Completion Information1

From	To	Dia	Description
41.0	46.0	10.00	.125 SCREEN
60.0	65.0	10.00	.80 SCREEN

Lithology Information

From	To	Description
0.0	3.0	TOPSOIL
3.0	17.0	CLAY GRAVEL AND BOULDERS
17.0	20.0	CLAY GRAVEL BOULDERS AND WATER
20.0	28.0	CLAY GRAVEL AND BOULDERS
28.0	30.0	CLAY GRAVEL BOULDERS AND 5 GPM
30.0	40.0	CLAY GRAVEL AND BOULDERS
40.0	46.0	SAND GRAVEL BOULDERS AND WATER
46.0	58.0	CLAY GRAVEL AND BOULDERS

58.0 65.0 SILTY CLAY GRAVEL BOULDERS AND WATER STATIC 8 FT 14 FT DRAWDOWN AT 60 GPM
65.0 75.0 CLAY AND BOULDERS

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

APPENDIX C

MBMG-GWIC Well Logs for Area

Ground Water Information Center
Wells Report

Retrieval Statistics *

Field	Max	Min	Count	Avg
Total Depth	75.00	30.00	6	56.18
Pumping Water Leve	l40.00	15.00	3	25.33
Static Water Level	17.00	9.00	5	12.00
Yield (gpm)	200.00	20.00	4	113.75

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

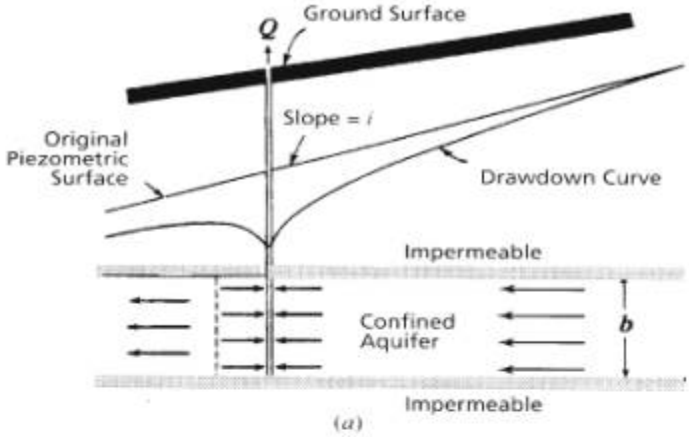
Gwic Id	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Use
70891		MARBUT GARY	14N19W 29AA	NO	WELL	30.00	15.00	12.00	20	11/1/1971	DOMESTIC
70892		GRANT CREEK RANCH CORP	14N19W 29ADDB	YES	WELL	56.00		17.00	75	12/1/1956	DOMESTIC/ IRRIGATION/ STOCKWATER
70893		GRANT CREEK ASSOCIATES LTD	14N19W 29D	NO	WELL	58.30	40.00	9.00	160	9/7/1979	MONITORING
70894		GRANT CREEK ASSOCIATES LTD	14N19W 29D	NO	WELL	57.80	21.00	11.00	200	9/7/1979	MONITORING
154492		GRANT CREEK WATER WORKS – WELL 2	14N19W 29DCDA	NO	WELL	75.00				9/25/1983	PUBLIC WATER SUPPLY
154496		GRANT CREEK WATER WORKS – WELL 1	14N19W 29DDCB	NO	WELL	60.00		11.00			PUBLIC WATER SUPPLY

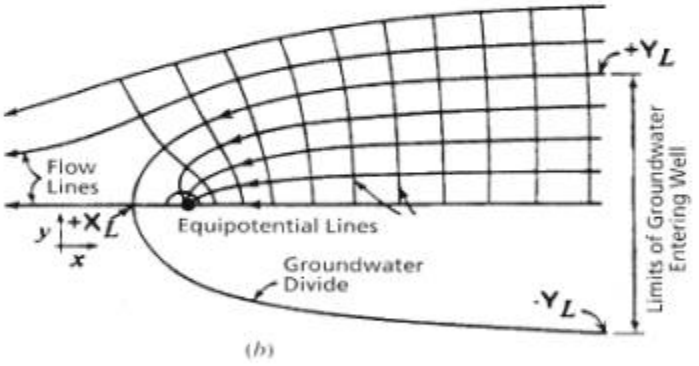
APPENDIX D

Time of Travel Calculations

UNIFORM GROUNDWATER FLOW EQUATION

Flow to a well penetrating a confined aquifer having a sloping plane piezometric surface - vertical section and plan view (Todd, 1980).





$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q}Y\right)$$

Uniform-Flow Equation

$$X_L = -\frac{Q}{2\pi Kbi}$$

Distance to Down-Gradient Null Point

$$Y_L = \pm\frac{Q}{2Kbi}$$

Boundary Limit

Legend:

- Pumping Well

Where:

Q = Well Pumping Rate
K = Hydraulic Conductivity
b = Saturated Thickness
i = Hydraulic Gradient
π = 3.1416

TIME-OF-TRAVEL CALCULATION METHOD

The time of travel for water to move along a line parallel to the hydraulic gradient, from a point to a pumping well (EPA 1991).

$$T_x = \frac{n}{Ki}\left[X_L - \frac{Q}{2\pi Kbi}\ln\left(1 + \frac{2\pi Kbi}{Q}X_L\right)\right]$$

T_X	=	travel time from point x to a pumping well
n	=	porosity
X_L	=	distance from pumping well over which groundwater travels in T_X
Q	=	discharge
K	=	hydraulic conductivity
b	=	aquifer thickness
i	=	hydraulic gradient

APPENDIX E

Inventory Sheets

APPENDIX F

Checklist

Department of Environmental Quality
Source Water Protection Program

CERTIFICATION CHECKLIST

Source Water Delineation and Assessment Reports (SWDAR)
For Community and non-community non-transient PWSs

The following items represent the minimum requirements for certification of a completed SWDAR for Community and non-community non-transient PWSs. The SWDAR represents the technical component of the SWPP, and mush be completed per the 1996 amendments to the Federal Safe Drinking Water Act. This checklist should be used in conjunction with the information and general format provided in the template for preparing SWDAR documents. While the format of the template may be modified as needed, all requested information should be included for certification.

For any items that are not applicable or information is not available, note in checklist column and provide and explanation. Attach additional sheets for explanation, if necessary.

Name of System:		**Grant Creek Water Works**
PWS #:		**3305**
Date Submitted:		**June 30, 2004**
Operator Name:		**Andy Mefford**
SWPP Contact:	Name:	Brian Walter
	Address:	1380 Starwood Dr. Missoula, MT 59802
	Phone:	(406) 542-0597
Person Preparing	Name:	Michelle Hutchins, Environmental Health Specialist
Plan Contact:	Address:	Missoula City County Health Department 301 W. Alder Missoula, MT 59802
	Phone:	(406) 258-4890

The following summary checklist is derived from the Source Water Delineation and Assessment Report template document. The completed plan should include summary discussions, when appropriate, for each listed item. Indicate the page and/or section number where this information is, or indicate not applicable (n/a) when appropriate. For items indicated as not applicable, the text should indicate why.

Introduction

	Page
Person who prepared document	iv
Name of system and county located in	iv
PWS Identification Number	iv
PWS contact person, with address and phone number	cover

Chapter 1 – Background

This section provides background information on the community served by the PWS.

	Page
1. The Community:	1
• Population	1
• Economic base	1
• Major water users	1
• Major waste generators	1
• Domestic sewage treatment and disposal	1
2. Geographic Setting	1
• Geographic setting, including surrounding area	1
• Physiographic features	1
• Streams and lakes	1
• Climate information (including annual precipitation and temperatures)	1
• A vicinity map at appropriate scale	Fig. 1

For surface water sources, or ground water systems influenced by surface water

• 8 and 11 digit USGS Hydrologic Units	n/a
• Montana Watershed Management Region	n/a
3. General Description of Source Water	1

Description of PWS system, including:

• Source of water (number of wells, depths, etc.)	2

- Well lithology and construction logs (in appendix) Appx B
- Distribution system 1, Appx A
- Number of connections and users 2
- PWS Treatment System 2

- Copy of latest Sanitary Survey (in appendix) Appx A

- A map indicating the general layout of the PWS. Appx A

4. Water Quality:

- Summarize enforcement actions in the past 5 years 2
- Describe background/regional water quality 2
- Table summarizing background water quality 3

For surface water sources, or ground water systems influenced by surface water

- Use classification n/a
- Threatened or impaired streams in watershed n/a
- TMDL development prioritization and status n/a

Chapter 2 – Delineation

This section provides information on the hydrogeology of the water supply for the PWS. Background information on the hydrogeologic setting should be assembled into a ***Hydrogeologic Conceptual Model*** that summarizes the ground water system in a simplified manner. The background information should support the process to delineate management areas.

		Page
1.	Hydrogeologic Conditions	4
•	Identification of references for hydrogeologic information	4
•	Summary tables of hydrogeologic studies and maps for area	5-6
•	Summary of wells in area from GWIC database	Appx C
•	Geologic map(s) included (if not, valid justification for omission)	Fig. 3
•	Geologic cross section(s) included	Fig. 5

For ground water systems:

- Identify aquifer 4
- Geologic setting of aquifer 4
- Aquifer properties (lithology, boundaries, etc.) 4
- Aquifer type (confined, unconfined, semi-confined) 4
- Connection with surface water 4
- Classify sensitivity of hydrogeologic setting of source water 4

For surface water sources, or ground water systems influenced by surface water

- Hydrogeologic setting of PWS watershed n/a
- Identification of references for hydrogeologic information n/a
- Stream flow characteristics n/a

2. Conceptual Model and Assumptions 6

- Seasonal trends in system 4
- Assumptions made to simplify model 9

For ground water systems:

- Aquifer boundaries 4
- Aquifer recharge areas 6
- Ground water flow direction 6
- Communication with surface water 6

For surface water sources, or ground water systems influenced by surface water

- Relationships of surface water with ground water system n/a

3. Well (or source) Information

For ground water systems:

- Well depths, construction details 7
- Well locations described 7
- Summary table of source information 7
  [Source information to include: PWS Source Code, Well Location, MBMG (GWID) No., MT Water Right No., Date Well completed, total depth, perorated interval, static water level, pumping water level, drawdown, test pumping rate, and specific capacity]

For surface water sources, or ground water systems influenced by surface water

- Description of source water intake system n/a
- Streamflow data, if available n/a

4. Delineation Methods and Criteria

- Overview of approach used for delineation 6

5. Model Input

For ground water systems:

- Identify analytical method used, with source reference 6
- Values of hydraulic parameters identified, with ranges 9
- Identify hydrogeologic parameter values used, with rationale 7-8
- Summary table of input values for model 9
- Reference and justification for assumed values 7-8
- Time of travel equations or model specifications 7-8

For surface water sources, or ground water systems influenced by surface water

- Time of travel calculations for surface water body n/a
- Summary of ranges for streamflow parameter values n/a
- Identify streamflow parameter values used with rationale n/a
- Summary table of input values for model n/a

6. Delineation Results

- Travel time calculation results, or computer model calibration criteria 9
- Management zones identified on map(s) Figs. 6 & 7
- Delineated areas reflect seasonal variations in hydrologic systems 9

7. Limiting factors

- Identify uncertainties in delineation approach based on assumptions 9
- Identify how uncertainties may effect delineated areas 9

Chapter 3 – Inventory

This section identifies all known and potential contaminant sources which may affect the PWS.

1. Inventory methods identified 10-11
2. Appropriate databases searched, with potential sources identified 10-11

For ground water systems:

Control zone 11

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

Inventory Region 11

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

Surface Water Buffer 12

Description of land uses
Description of potential contaminant sources for pathogens (acute health hazards)

Recharge Region 15

Description of land uses
Description of large potential contaminant sources
Large potential sources and land use shown on a map

For surface water sources, or ground water systems influenced by surface water

Spill Response Region n/a

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

- ***Watershed Region*** n/a

Description of land uses
Description of large potential contaminant sources
Map of watershed region showing significant potential contaminant sources
(e.g. MPDES permitted discharges, to the extent practical with existing databases)

For all systems

- Inventory update – procedures to update every five years 15
- Inventory limitations identified 15

Chapter 4 – Susceptibility Assessment

This section evaluates the potential for the PWS water supply to be contaminated by the significant potential sources of contamination identified in Chapter 3. This information can be used by local officials to prioritize management actions for the delineation control and inventory zones. Worksheets to be considered when completing each task are listed with each topic.
Attach completed worksheets as Appendices to final document

1. Hazard of potential contaminant sources identified 17-19

2. Barriers for each potential contaminant sources identified and evaluated 17-19

   - Supporting information for identification of features as barriers 17-19

3. Threats from significant potential contaminant sources ranked 17-19

References

All technical references are listed in the appropriate format 21-22

Appendices

All necessary supporting information is included in Appendices yes

List any Deficiencies:

none

APPENDIX G

Letter of Concurrence

Source Water Protection Section
Department of Environmental Quality
POB 200901
Helena, MT 59602-0901

RE: Source Water Delineation & Assessment Report

To Whom It May Concern:

The Grant Creek Water Users' Association public water system has reviewed the source water delineation and assessment report (SWDAR) dated June 2004. We concur that the delineation component appears to describe current conditions at the water system based on reasonably available information and that the susceptibility assessment identifies the origins of regulated contaminants to the extent practical.

We understand that the Grant Creek Water Users' Association PWS SWDAR will be made available to the public by DEQ as described in the Montana Source Water Protection Program. Also, we will make a copy of the report available for the public to view during our normal office hours and describe the results in subsequent releases of our consumer confidence report.

Signed,

_____

Signature Title and Date

Figures